

# PUBLIC WORKS

CITY

COUNTY

STATE

**Tarvia**  
For Road Construction  
Repair and Maintenance

Tarvia Auto Truck  
Distributor

Main St., Harlingen, Tex. Tarvia surface treatment since 1920

## Along the Rio Grande—

Twenty-five years ago the Rio Grande Valley, in southern Texas, was an arid, desert waste. Today it is called the "Winter Garden of America."

Irrigation, which the courageous, resourceful settlers secured by pumping water from the Rio Grande, has transformed the stretches of barren sand into fertile farms and plantations. And good roads, which have been obtained by surface-treating the natural caliche and adobe gravel roads with Tarvia, bring the diversified crops, worth millions of dollars annually, within easy reach of the railroads and marketing centers.

In the Valley are thriving towns, the largest of which are Mission, McAllen, Mercedes, and Harlingen. Here, too, the broad Tarvia-paved streets give unmistakable evidence of prosperity and sound, substantial growth.

In selecting Tarvia for all their road-building and road-maintenance work, these far-sighted pioneers showed characteristic good judgment. For with no other material could they have converted, at such small expense, their unimproved roads into smooth, dustless, mudless, all-year highways.

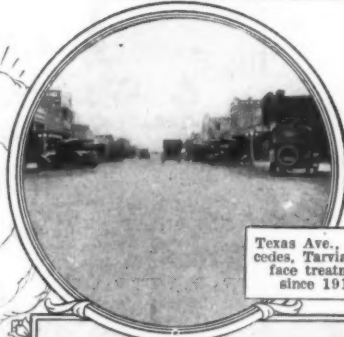
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Avenue of Palms, McAllen, Texas. Tarvia surface treatment since 1919



Texas Ave., Mercedes, Tarvia surface treatment since 1919



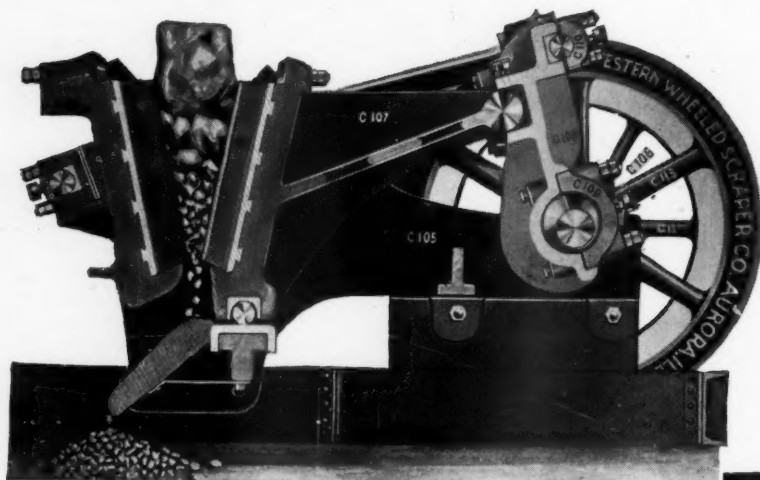
La Lomita St., Mission, Tarvia surface treatment since 1919



Illustrated booklets descriptive of the various uses of Tarvia will gladly be sent free upon request.

OCTOBER, 1922

# Western-Aurora



*The  
Jaw Crusher  
that is  
Different*

**D**IFFERENT in design. Look at the sectional view. Not a time-wasting spring to break, or toggle to fall out.

Also—and what is even more important—a continuous double-stroke crushing motion which increases capacity, reduces vibration and economizes power.

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A Western-Aurora Crushing Plant is a mighty fine investment from every angle.

*Other reasons are found in Catalog 44-S  
We would like to send you a copy*

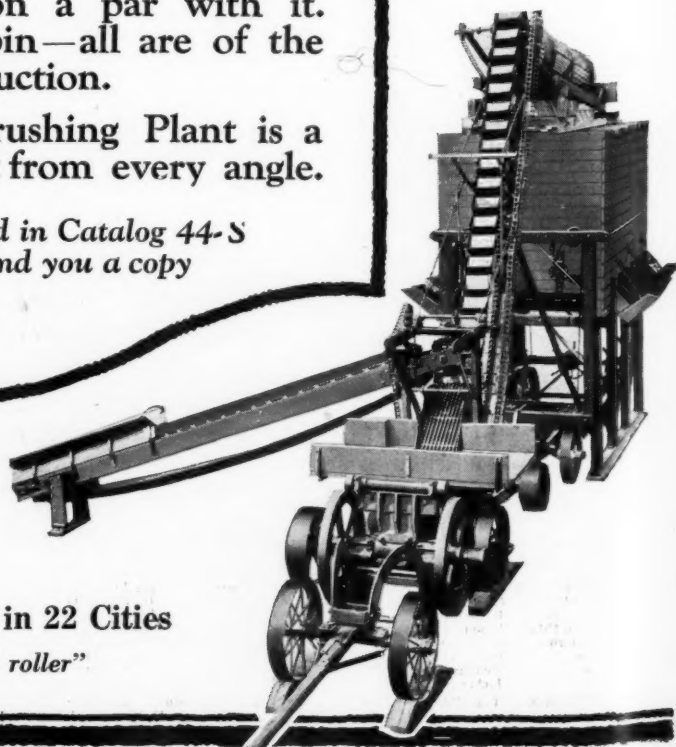


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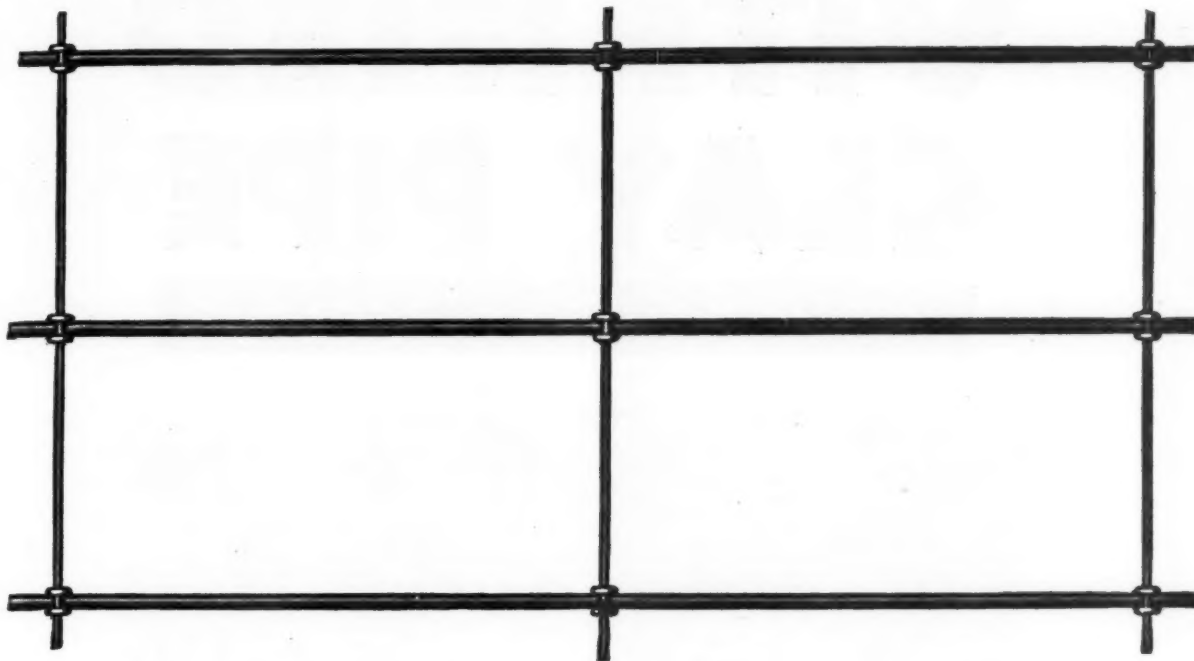
*"Everything from a drag scraper to a road roller"*





## "Highly Satisfactory"—

Carey, Campbell & Company write from Naples, N. Y.—"We wish to say that the flat sheets of Mesh Reinforcement furnished by the Truscon Steel Company have proven highly satisfactory. Their shipments have been prompt, and their cars well and conveniently loaded, which was quite an advantage in handling it."



### Truscon Wire Mesh in Flat Sheets

saves time and labor in concrete road work. The wire used in Truscon Mesh is straightened before fabricating with the result that the completed sheets lie absolutely flat. Truscon Staple Joints make absolutely rigid connections and assure sheets remaining in perfect form during all necessary handling. Flat sheets are furnished cut to exact lengths. Mesh in 6 in. x 12 in. in various areas and weights to meet all requirements. Get our estimates.

## Truscon Steel Company YOUNGSTOWN, OHIO

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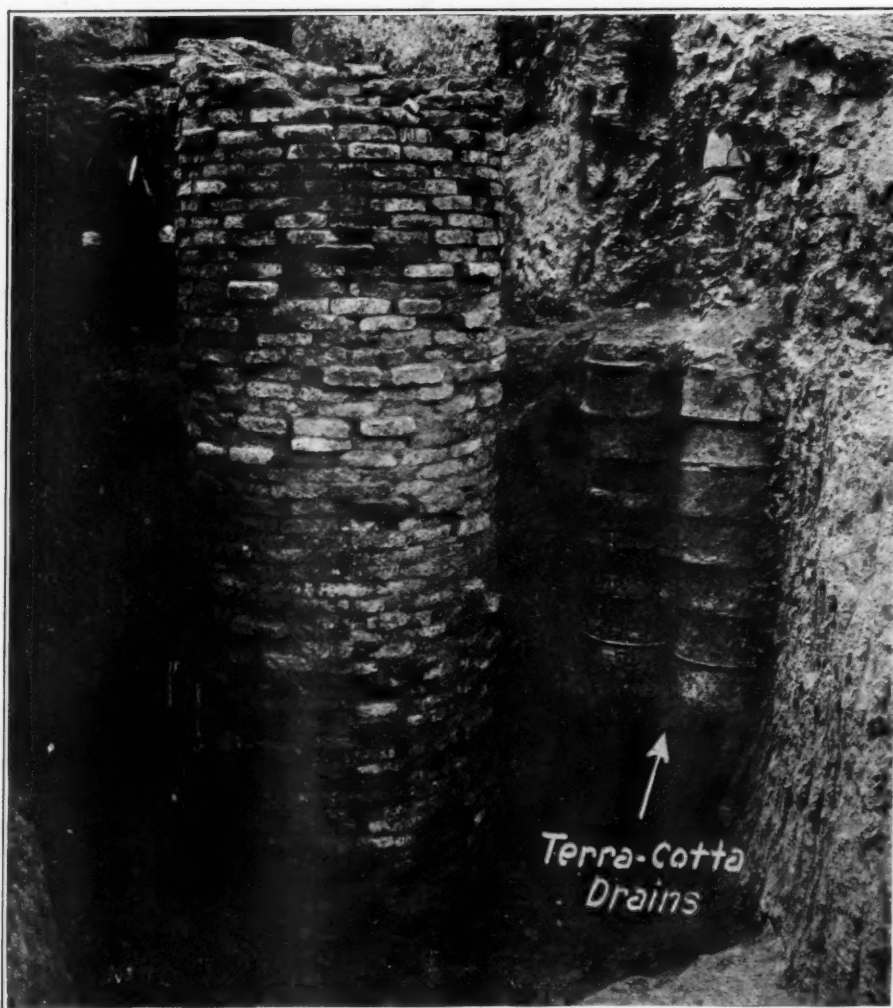
### Truscon Curb Bars Protect Concrete Edges

Manufactured under powerful machinery from special steel sections, Truscon Curb Bars are designed to give ample protection without waste of material. Positive anchorage, rigidity and convenient size make Truscon Curb Bars easy to handle and install, and effective in actual use. Furnished either straight or curved, standard lengths 6, 8, 10 and 12 feet.



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*The Pipe Everlasting*



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# The Ancients used Clay Products in their systems of sanitation

Well constructed drains of terra cotta pipe have been unearthed after being buried for thousands of years, most of which are in a good state of preservation today.

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## Vitrified Clay Pipe

has ever been the one material to successfully resist all corrosion and present a permanent, cleanable surface.

We have ready for distribution a number of publications which will be of interest to you, including a handbook on sewers and house drains. Allow our engineers to cooperate with you on your problems.

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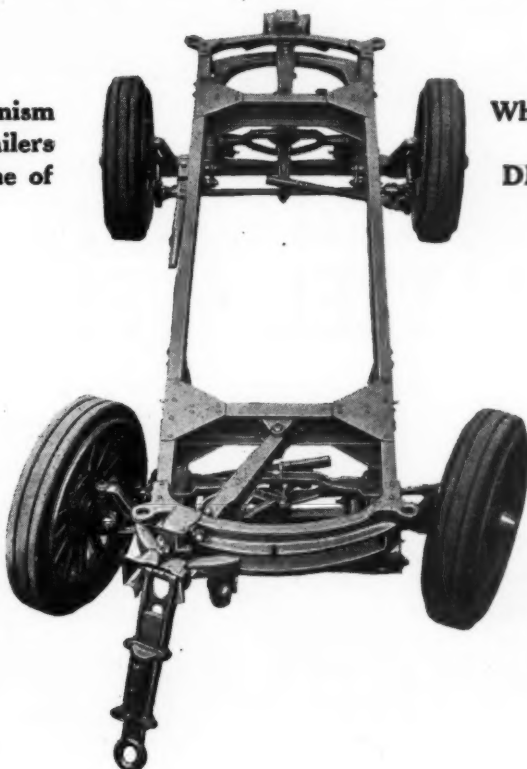
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DETROIT TRAILERS

# DETROIT TRAILERS

The steering mechanism compels Detroit trailers to follow the true line of the truck.



Wheels are never out of alignment.  
**DETROIT TRAILERS DO NOT SWAY**

Connection is made instantly with truck. No time lost.

No clevis bolts to poke through. No cotter pins to bother with.

## WATCH IT TRACK—SEE IT BACK

A tie rod independent from the drag link connects knuckle steering arms, thus always keeping the wheels parallel—keeping wheels in alignment and saving tires.

Steering arm is pivoted on the axle. The relation between the steering arm and steering knuckle is therefore always constant and prevents side sway.

**DETROIT** Trailers can be backed singly, or in trains of two or more without any chance of injury to operator. It only takes a few seconds to reverse a **DETROIT** Trailer for backing or for pulling from the opposite end. The swivel draw head and

other patented features give it advantages over all other makes.

Knuckle type axles insure four point suspension at all times when backing up or when turning sharp corners. Extension draw bar is equipped with double acting springs, which absorb shocks and prolong life of truck and trailer.

The **DETROIT** Trailer lock is housed in and is packed in grease. No dirt or grit can get on the inside.

**MADE IN ONE OF THE LARGEST TRAILER PLANTS IN THE WORLD.**

Let our engineers recommend a type to suit your requirements.

# Detroit Trailer Company

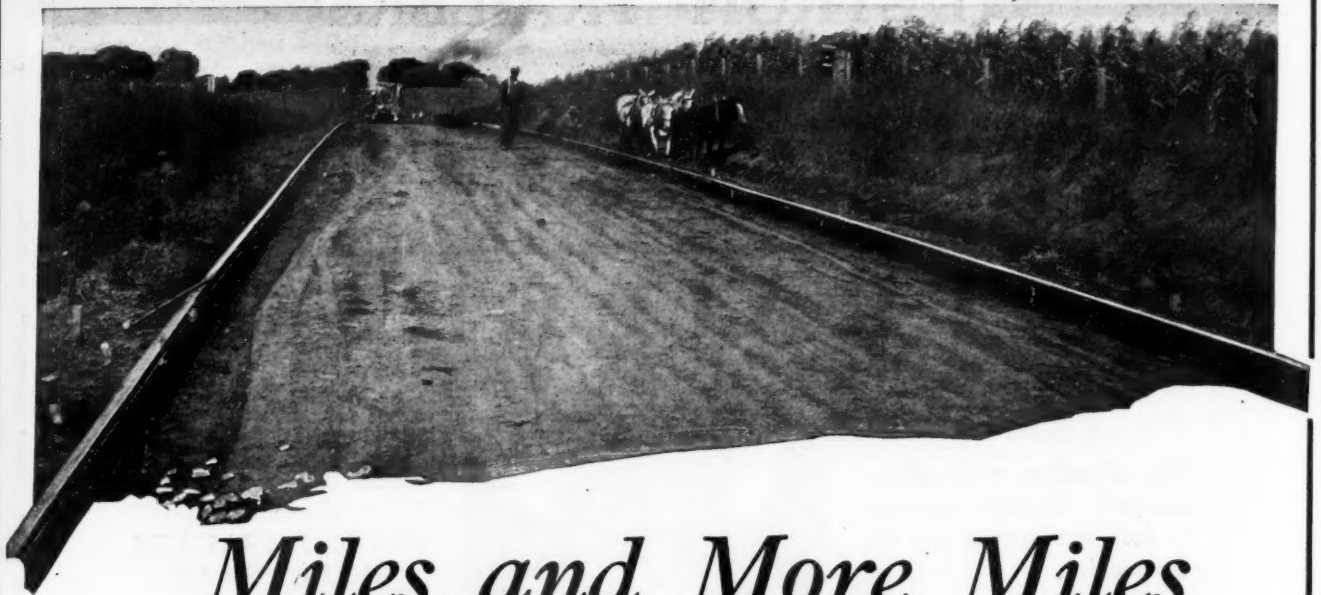
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## *Miles and More Miles* of **HELTZEL STEEL FORMS**

*A Rail  
A Pedestal  
A Stake  
that's all*



The Union Paving Company of Philadelphia purchased nearly thirty thousand feet of Heltzel Steel Road Forms.

Their first order called for 3,000 feet; their second order called for 16,000 feet; their third order called for 10,000 feet.

During the first six months of this year over 150,000 feet of this form was sold in Illinois alone. Geo. T. Wilhelm used Heltzel Forms on his 60 mile job in Arkansas.

C. F. Lytle, Contractor, Sioux City, Iowa, used 8,000 feet and ordered 10,000 feet additional 6" Heltzel Forms for his 48 mile job in Florida.

They all pin their faith to Heltzel Forms—WHY? Ask any one of them what they think of Heltzel Forms.

In the meantime, write for literature. You are not obligated by so doing. Why not write now? A one cent postal will bring full information.

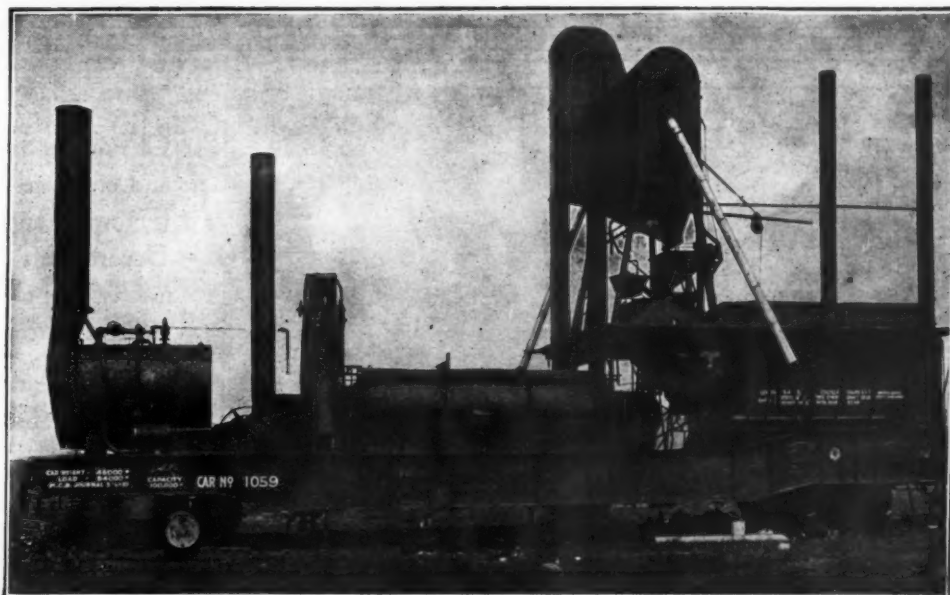
***The Heltzel Steel Form & Iron Co.***  
***Warren, Ohio***

Largest exclusive builders of steel forms for Road, Sidewalk, Curb, Curb and Gutter and all types of concrete construction; Tamping Machines, Heltzel Hand Strikeoff Tamp, Heltzel Rotary Steel Float, and other accessories.



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PORTABLE  
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Sand & Stone  
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Large dryer five feet in diameter and has our improved internal construction. The fire box is large and easily fired from grade level.

Asphaltic cement is kept in constant circulation through the Hetherington Steam-Jacketed CENTRIFUGAL Pump and steam-jacketed pipe line.

Hinged Sand Bin—Side Delivery Conveyor—Mixer permanently located, and you never have to move it when assembling for operation.

QUICKLY ASSEMBLED. Six hours' time, with an experienced crew and the plant is ready to operate.

GOOD CAPACITY. You will find this plant just the right size for your average contract.

*Write for full particulars.*

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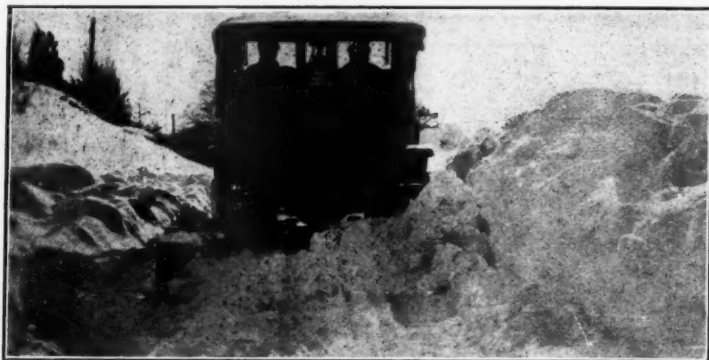
# When Winter Comes

—AND STREETS AND ROADS ARE FILLED WITH SNOW

*How are such highways to be quickly and economically opened for travel?*

THERE IS BUT ONE ANSWER TO THIS IMPORTANT QUESTION: BY USING

## Champion Snow Plows



Champion Snow Plow Opening Danbury, Conn., Road

Champion Snow Plows are used and endorsed by Towns, Cities, Counties and State Highway Departments as the only practical means of cleaning snow from streets and roads.

Easily and quickly attached to any standard motor truck or tractor.

The cost of the Champion Plow is insignificant when compared with the amount of work it will do. One of these plows will save its initial cost in clearing snow from highways after one storm.

Plows should be ordered now and they will then be on hand when needed. It is too late to get them after the snow comes.



Champion Snow Plow Clearing Snow from the Streets of a Large City

Catalogue furnished free on request. Write to-day for your copy. It will be furnished without obligation.

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## means "Tilting Drum" ~and That Means Mixing Efficiency

**T**HE next time you pass a concrete mixer out on the job, stop and notice how the batch is emptied out of the drum. Is it done by a simple tilt of the drum which pours the entire batch out—quickly, cleanly, completely? *Then it's a Jaeger!*

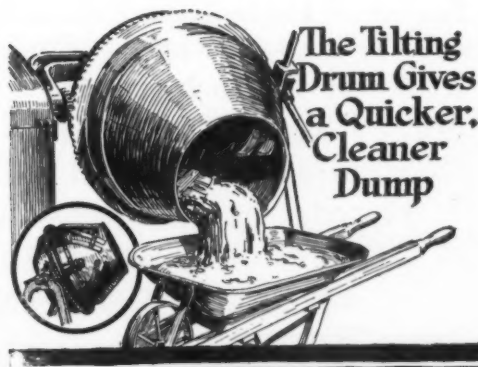
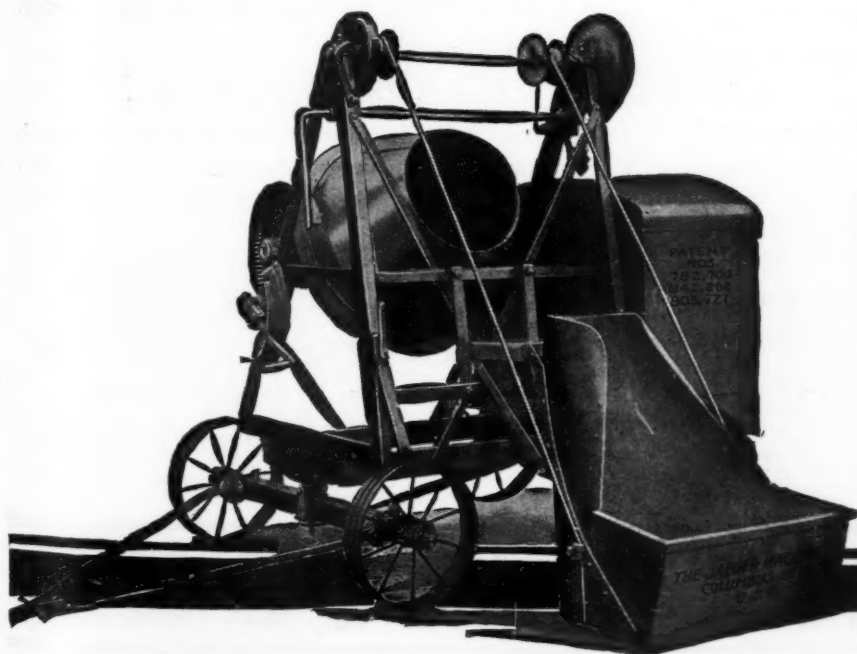
More than 35,000 of the 70,000 concrete mixers in use are tilting drum machines. *And of these 18,000 are Jaegers!* Consider that the concerns producing tilting drum mixers are far outnumbered by manufacturers of other types and you get a fair idea of the wonderful popularity of this type mixer.

There's a reason. The tilting drum mixer gives a *more thorough mix and a quicker, cleaner discharge* than any stationary drum machine can hope to do. To discharge, simply tilt the drum and pour the batch out—a 10-second job, as easy and quick as emptying a bucket of water.

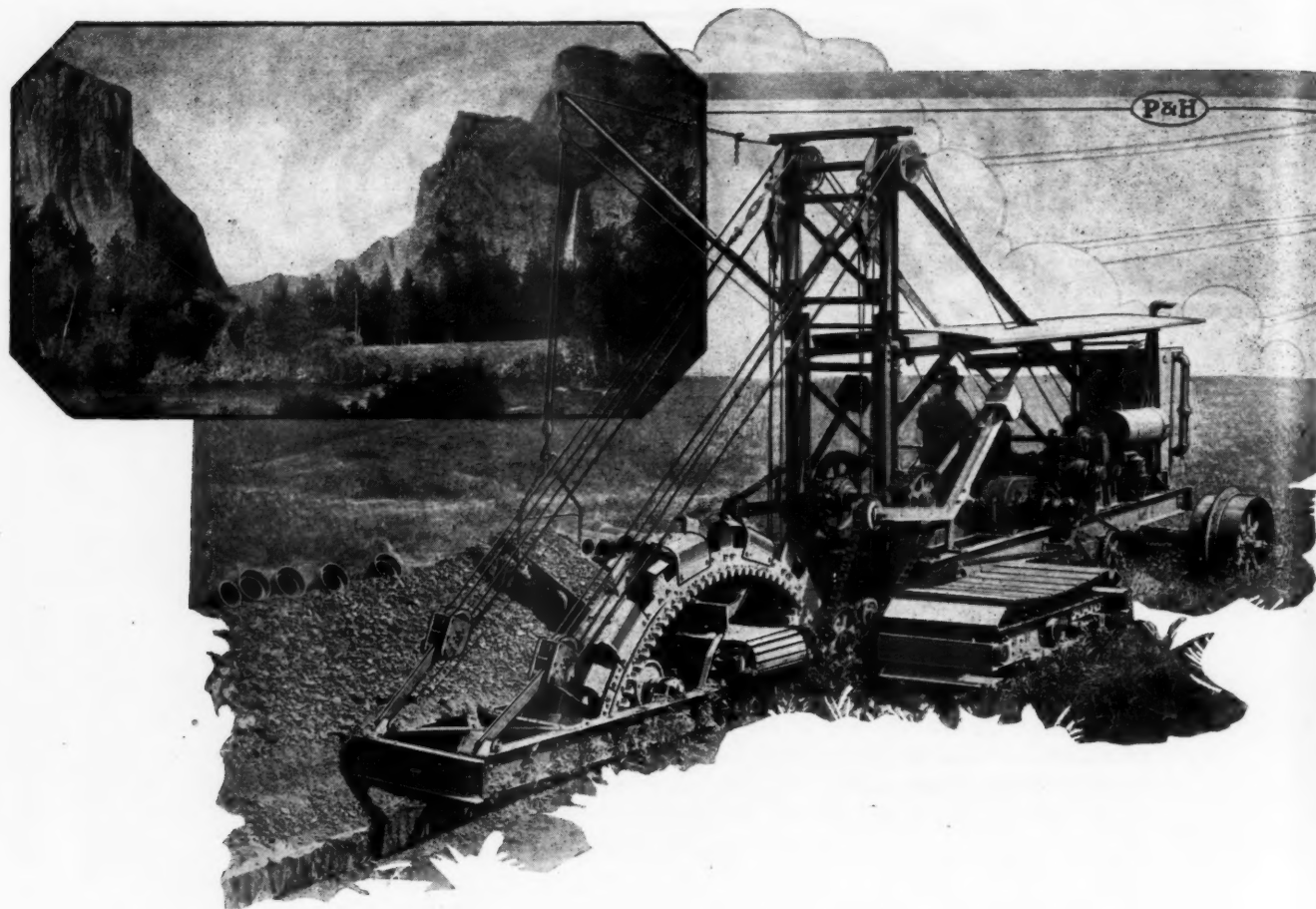
*Speed without the sacrifice of thorough mix*—that is the outstanding feature of the tilting drum machine. Combine this speed with Jaeger simplicity and mixing efficiency and you have a 100% mixer.

Compare the Jaeger, point by point, with any other type mixer and your choice invariably leads you to this tilting drum machine. Our catalog, describing the complete line of 14 Jaeger mixers will be sent on request.

**The Jaeger Machine Company**  
400 Dublin Ave. Columbus, Ohio







## As Substantial as El Capitan

In the Yosemite National Park, where El Capitan stands so regally and formidably, the P & H T22 Trench Excavator is staunchly cutting a trench for the new sewage disposal system.

This same machine owned by the Schultz Construction Co., of San Francisco, has already dug 12 miles of trenches for the Water System of Davis, Yoho County, Calif. With but *one* man—the operator—an average of 3,500 feet of trench was dug on 10 gallons of gasoline and one pint of oil.

At Roseville it dug eight miles of trench for concrete pipe, after which it was operated at Tranquility, and thence sent to Yosemite.

### What the Owners Say

"This P & H Trench Excavator is the greatest money-maker we have ever had," is what Messrs.

Schultz and Currey say. And you'll say the same if you put a P & H to work on your next trench excavating job.

### What the Owners Did

Just sent an order for a second P & H Trench Excavator—(This time the ladder type). This more than backs up the owners' opinion and what they say.

*Bulletin 15-X sent on request.*

Excavating Machinery Division

**PAWLING & HARNISCHFEGER CO.**

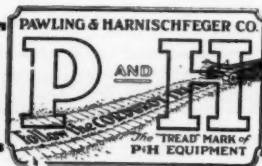
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# EXCAVATORS



SCARIFYING MACADAM BEFORE RESURFACING

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The "Caterpillar's"\* field of usefulness is by no means limited to civic and public works. There is a "Caterpillar"\* of size and capacity for every power need. On farm or ranch, in the mining, oil and lumber industries, for snow removal, wherever tractive power and endurance are at a premium, the "Caterpillar"\* has no real competitor.

Note only are "Caterpillar"\* Tractors without an equal in compactness of design, staunchness of build, and consistent pulling power—they are backed everywhere by prompt Holt service. Our branches and distributors maintain fully equipped service stations, that are real service stations, in all parts of this and foreign countries. Wherever street improvement, hauling or dirt moving projects are being put through, public officials and engineers find Holt Service within easy reach. Because it is complete and always accessible, Holt Service puts real significance into the guarantee under which every "Caterpillar"\* is sold. Let us send you interesting facts and figures or arrange a motion picture exhibition of "Caterpillars"\* at work.

\*There is but one "Caterpillar"—Holt builds it. The name was originated by this Company, and is our exclusive trade-mark registered in the U. S. Patent Office and in practically every country of the world.

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# YOU WILL SAVE MORE THAN YOU SPEND

Over a period of years the difference in upkeep costs, in comparison with other types of pavements, will show

## WARRENITE-BITULITHIC PAVEMENT

Costing enough less per mile per year to offset the amount spent for its installation.

You can lay roads for less—but you cannot get as good a road for so many years at anything near the ultimate cost of this pavement.

*May we send you booklets to prove this?*

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## Use Elastite Joint on all jobs

**I**N bridges, retaining walls, riprap and other construction where it is practically impossible to make poured joints Elastite can be installed as easily as a spacing strip in making a road-joint.

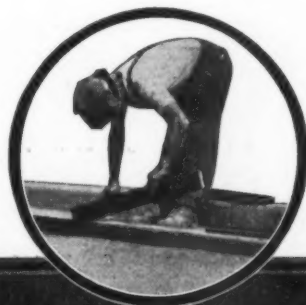
Elastite is the only "sandwich" joint, being a body of tempered asphalt between two layers of felt. It is this unique construction that gives Elastite its peculiar characteristics of compressibility within its own volume and elasticity in any temperature, making it a water-tight and frost-tight joint which does not chip, or flow in hot weather, nor squeeze out of the joint, does not deteriorate in weather or storage, and is as easy to handle as lumber.

Elastite is a proved joint for all concrete work, including levees, reservoirs, walls, riprapping, bridges, flumes and dams, as well as roads, streets and sidewalks. Elastite is cut to form or any size and thickness and shipped in any quantity from ample stocks carried in seventeen distributing centers. Write for sample and information.

**THE PHILIP CAREY COMPANY**  
10 Wayne Avenue, Lockland, Cincinnati, Ohio

### *A few Elastite installations*

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# Stanolind

## Paving Asphalt



### The Perfect Boulevard

**T**HE shock and grind of thousands of whirring wheels has no effect on the boulevard constructed with *Stanolind Paving Asphalt*. Its supple surface provides a wearing course of extreme durability, absorbing the heavy impacts of traffic and protecting the foundation.

Noise, an objectionable feature of brittle pavements, is eliminated when *Stanolind* is used. Water, the greatest destroyer of all pavements, is defeated by the waterproofing materials inherent in *Stanolind*.

And the low initial first cost as well

as the still lower maintenance cost, together with the notable long life of asphalt pavements, all go to make *Stanolind Paving Asphalt* the perfect paving material for boulevards.

Many boulevards which were constructed with *Stanolind Paving Asphalt* years ago are still in excellent condition although not one cent has been spent upon them for repairs.

If you are considering the installation of a boulevard system our engineers will gladly consult with you with the end in view of helping you solve your road problems.

A NEW BOOKLET RECENTLY ISSUED BY US TELLS THE LATEST METHODS OF CONSTRUCTING AND MAINTAINING BITUMINOUS PAVEMENTS. SENT FREE TO ENGINEERS AND COMMUNITY OFFICIALS WHO REQUEST IT ON THEIR OFFICIAL STATIONERY.

## STANDARD OIL COMPANY

(INDIANA)

931 S. Michigan Ave.

Chicago, Illinois

# O.S. **DEPENDABLE**

## LOCOMOTIVE CRANES and BUCKETS

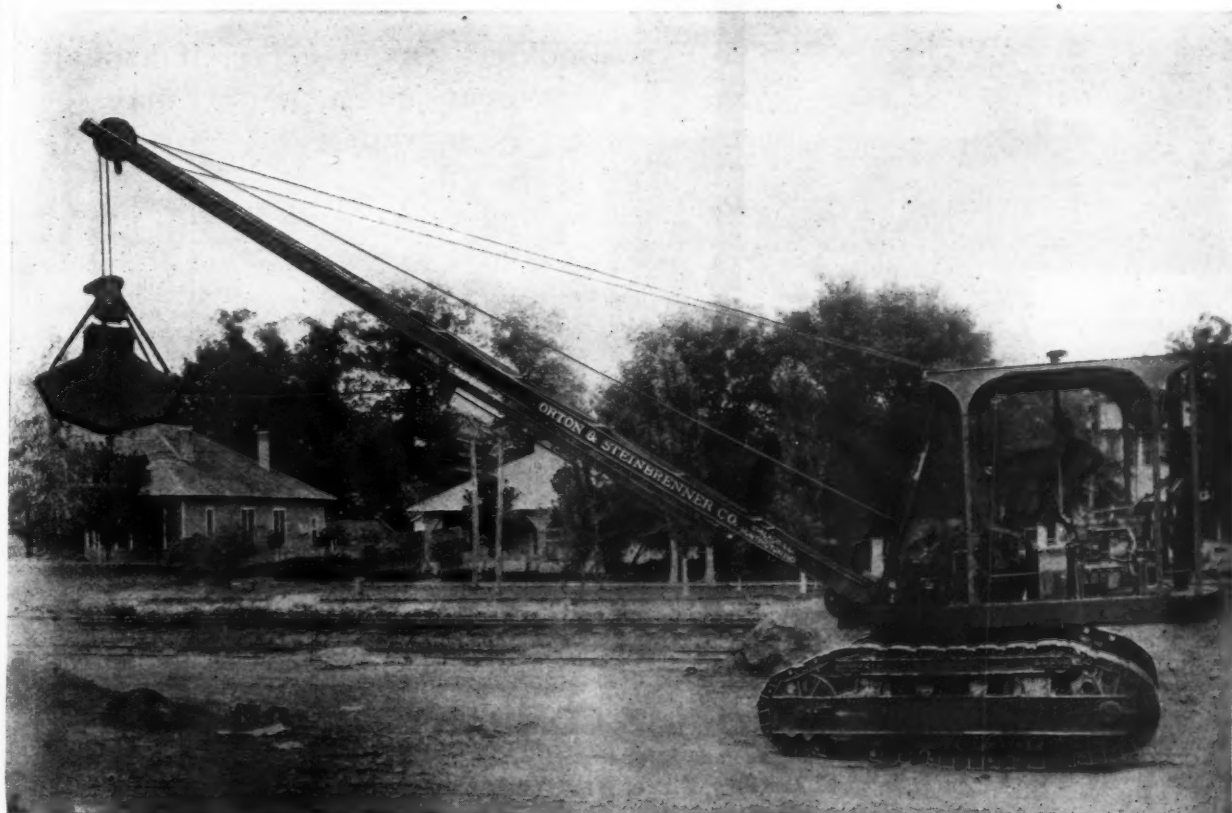
Insure Dependable Performance, due to the intelligent selection of materials and the painstaking methods of production.

### ORTON & STEINBRENNER COMPANY

Offices: 608 So. Dearborn St., Chicago, Ill.

Shops: Huntington, Ind.

Capacities: 7 to 60 Tons



7-Ton Crawling Tread—30-ft. Boom— $\frac{3}{4}$  cu. yd. Bucket—Gasoline Motor Drive



# For County Roads

The splendid service being rendered by TEXACO ASPHALT pavements on hundreds of miles of county highways—

Subjected to widely varying climatic conditions—

And continuously bearing weighty trucks laden with the produce of farm, forest and mines—

Together with the excellent record of TEXACO ASPHALT pavements under the heavy traffic of city thoroughfares—

Proves that these pavements are ideal for the hard service demanded of county roads.

Booklets on all types of asphalt pavement construction may be had upon request.



Typical traffic on TEXACO county highways. Sherard Road, Coahoma County, Miss.

## TEXACO ASPHALT

### THE TEXAS COMPANY

*Asphalt Sales Department*

17 Battery Place, New York City



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# PUBLIC WORKS.

CITY

COUNTY

STATE

A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"

Vol. 53

October, 1922

No. 8

## Building Rockaway Boulevard

**Roadway 10,000 feet long constructed by hydraulically dredged fill deposited between two lines of turf retaining walls. Special details developed for delivering materials over new fill and for setting forms on sand**

A portion of the highway from Jamaica, Long Island, to Far Rockaway, passes over the marshes at so low an elevation that the tracks of the electric car line laid in the road are occasionally submerged by high tides. During the summer season there is a great deal of travel over this road, and it was in such poor condition last year that it became necessary to make substantial improvements and contracts were awarded last fall by the Highway Department of the Borough of Queens for approximately \$300,000 to Angelo Penio of Brooklyn, for the construction of a section about 10,000 feet long, at a materially higher ele-

of similar roads to be built in the future. It is virtually a causeway 50 feet wide on top and from 2 to 6 feet in general elevation above the original surface of the adjacent marsh. The concrete pavement, 20 feet wide, has a uniform thickness of 6 inches, is crowned 2 inches in the center and is reinforced by single mesh weighing 1.06 pounds per square foot. The road crosses two creeks with girder bridges of a little less than 30-foot spans and will provide for the trolley service that before and during its construction was maintained on the old road parallel and closely adjacent to it.



SOD WALLS FOR RETAINING SAND FILL AT CREEK CROSSING.  
Pipe from hydraulic dredge shown in white on top of sod wall at right background.

vation, requiring a fill of from 2 to 10 feet for its entire length; also for paving it with concrete. The work was considered especially difficult on account of the soft ground and the large amount of embankment required on it.

The road is the first of its type in this borough, and its satisfactory completion and maintenance will afford a precedent for a considerable amount

Work was commenced November 1, 1921, and it is expected will be finished early this Fall. The principal quantities involved are about 140,000 cubic yards of fill, 10,000 cubic yards of sod embankment and 22,000 square yards of concrete pavement requiring about 6,000 yards of trap rock and 2,000 yards of sand.

The first important construction item was the



ROAD TO BE MADE BY FILLING SAND BETWEEN THE SOD WALLS.

building of the long, continuous embankment 50 feet wide, with side slopes of 1.2. This was made with a minimum of hand labor. Along each side of the road was laid up a continuous sod bank or dam 5 feet wide at the bottom,  $3\frac{1}{2}$  feet wide on top, and from  $3\frac{1}{2}$  to 5 feet high. These were built entirely of well bonded 12 x 24-inch pieces of turf about 2 feet thick laid up with sand and earth fill and covered with earth or sand.

The turf was cut alongside the road from the surface of the marsh by men with special spades which had the blades bent at right angles to form a three-sided U-shaped cutting edge open on the fourth side. This was forced horizontally through the ground, removing the turf, which was delivered to a man who, using a special fork having the tines bent at right angles to the handle, placed the turf into position in the dam; or, if the distance was too great, he placed it on a wheelbarrow by which it was carried to the required position. The work was done by gangs of four men who received from 70 cents to one dollar per cubic yard for cutting the turf and building the dam. The sod banks were built at an average rate of about 50 cubic yards per eight-hour day for each gang.

After the dams had stood for at least 30 days, the space between them was filled by hydraulic dredging. The fill was dredged from Jamaica Bay by a 16-inch centrifugal pump and delivered through a maximum length of about 6,200 feet of Jackson Brothers' spiral lockwelded pipe 16 inches in diameter. This pipe was laid on the surface of the ground except for a length of about 200 feet adjacent to the dredge boat, where it was supported on scows.

Most of the sand was deposited within 300 feet of the outlet of the pipe, the water immediately draining off through the porous banks so as to leave the top of the fill always exposed. One of the dams was so close to the old trolley line that some of the overflow washed over the latter, and, to prevent this, the water was deflected from this side of the fill as much as possible by the use of 42 x 72-inch sheets of 16-gage iron used as baffle plates parallel to the dam for a distance of about 50 feet from the outlet of the dredge pipe.

The fill was deposited by the 16-inch dredge pump at the rate of about 1,000 yards in 24 hours. A smaller pump

was installed near the other end of the section, but did not give as satisfactory results.

#### SETTLEMENT OF MARSH

The surface of the marsh settled considerably under the weight of the fill, causing displacement of the soft mud and upheaval of the top of the marsh beyond the sides of the fill, which necessitated considerable leveling and grading of the old trolley tracks and required a much larger amount of embankment than was indicated by the original estimate.

The excess fill was determined by measurements made on settling boards after the fill had been completed, these being boards 2 feet square placed about 200 feet apart on the surface of the marsh before the fill was deposited over them. A vertical stake 4 x 4-inch and 16 feet long was driven to refusal through a hole in the center of each board and the elevation of the board indicated on the stake. As the fill was deposited, the settling board was forced down the vertical stake as a guide and after the fill had been completed and settlement ceased a sounding rod or leveling rod was driven down to rest on the top of the board and an accurate measurement from it to the first position of the board showed settlements of from 6 inches to 4 feet below the original elevation, which determined the amount of excess embankment paid for under the contract. It was found that the depth to which a pedestrian standing on the surface of the marsh would sink in 5 or 10 minutes corresponded roughly to that determined by the settling boards.

After the fill was at least 30 days old no additional settlement could be perceived and the construction of the concrete pavement on it was commenced. The outer sides of the turf banks will be protected by a sand revetment covered with 6 inches of steam ashes well rammed to retain the sand and prevent it from being washed away by rains or blown away by high winds to which the open marshes are exposed.

#### CONSTRUCTING THE PAVEMENT

The 6,000 yards of broken trap rock required for the concrete was shipped by boat from Branford, Conn., to Flushing, and thence was hauled to the end of the contract section in 16 rented 5-yard trucks and dumped from an elevated platform into a hopper, from which the service cars



SOD WALL BETWEEN TROLLEY TRACK AND ROAD LOCATION, AND BETWEEN LATTER AND HOUSE. FINISHED PAVEMENT IN FOREGROUND.

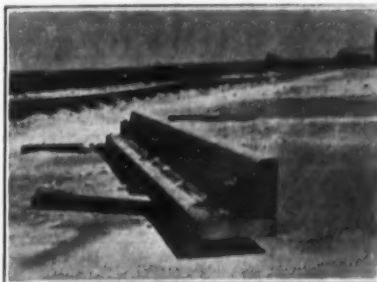


were loaded by gravity. The sand was handled in the same way, but as the accommodations were not always sufficient to provide for the large number of trucks employed, some of the material was necessarily dumped on the ground and then loaded into the service cars by an Erie steam shovel with a one-yard bucket.

From the loading hopper the aggregate was delivered to the concrete mixer by two trains, each having 3 or 6 one-yard, side-dump cars hauled by a Fordson tractor on a 26-inch gage service track which ran alongside the mixer and dumped the materials as nearly as possible in the required position, whence they were shoveled by hand into measuring wheel barrows that dumped them into the mixer hopper. This arrangement was found necessary because it was impracticable to haul the aggregate to the mixer in trucks either on the existing roadway or on the new fill. In order to lay the tracks on the hydraulic fill it was necessary to provide an unusually large bearing surface, which was accomplished by supporting the 5,000 linear feet of 20-pound rails on 3 x 10-inch wooden cross ties 4 feet long and 2 feet apart on centers. It was also necessary to lay planks over the surface of the fill for the moving of the concrete mixer and other heavy plant or trucks.

The concrete was mixed in a Rex chain belt machine with a capacity for 21 cubic feet of wet mix, and was laid at the maximum rate of 284 feet in an 8-hour day. The subgrade of moist sand was trimmed to a convex surface exactly parallel with the finished surface of the pavement and finished with a screed. On this the concrete was laid directly to a depth of 3 inches and screeded, after which the reinforcement mesh was placed on it and the second course of concrete immediately laid and finished with a Lakewood New Way machine traveling on special side forms of the Lakewood type. As these forms could not be satisfactorily held in the hydraulic fill, their lower flanges were bolted to 3 x 10-inch planks making L-shaped cross-sections and were nailed every 3 feet to 2 x 4-inch stakes 5 feet long driven firmly into the sand.

During the Spring and Fall weather the concrete was wet down when necessary with a hose but was not covered with earth or straw. Water for this purpose and for the concrete was purchased from the city, supplied and delivered



SIDE FORM FASTENED TO PLANKS TO GIVE BEARING ON SAND.

through a maximum of 5,000 feet of 2-inch pipe.

Expansion joints about 100 to 150 feet apart are made at the end of each half day's work and consist of a double thickness of tarred fibre, which was

found to give better results than a single thickness at first required. An average gang of 30 men is required to operate the mixer, prepare the subgrade and place and shift the forms, which are kept about 500 feet in advance of the paving machine. Five thousand linear feet of Lakewood forms are provided and are taken up, cleaned and moved forward on the dump cars on the service track.

The road crosses two creeks with bridges having 27 and 29 feet spans respectively, each made with 11 lines of beams solidly enclosed in concrete and carrying a reinforced concrete floor slab. The girders are supported on heavily buttressed concrete abutments with foundations consisting of about 45 12-inch piles, 25 feet long for each abutment. Each abutment was constructed in an open 15 x 50-foot cofferdam made of 4-inch tongue and groove wooden sheet piles 28 feet long, retaining the earth from an excavation 17 feet below water level. The foundation piles were driven with a 1,000-pound drop-hammer pile driver assisted by a hydraulic jet of 80-pound pressure through a 3/4-inch nozzle. The same nozzle was used in driving the sheet piles which were carefully assembled between rangers and were driven so closely that the cofferdams were unwatered by an 8-inch centrifugal pump, leaks through the sheeting being calked with oakum and paving pitch.

The work has been executed under the direction of J. L. Rice, engineer in charge, and H. R. Prosser, construction engineer for the contractor.

### Sand Centering for Culverts

In an Indian Reservation in California a concrete culvert 30 inches wide and 40 feet long, had a top cover formed of a segmental concrete arch that was cast in place on a well packed sand fill or core covered with tar paper. A small open space was provided on the concrete invert by means of two 6x6-inch boards placed at right angles to form an A shape cross-section with the lower edges elevated on one-inch blocks.

After the concrete top slab was set, a stream of water was passed through the opening of the culvert, washed out the sand core, and floated the 6x1-inch strips free of the culvert in a very few minutes, thus avoiding the expense of permanent form and the difficulty of removing an ordinary wooden form.



LOADING PLATFORM, FORDSON TRACTOR ON FLANGED WHEELS, AND ONE-YARD DUMP CARS.

## Stream Pollution Investigation

**Outline of work being done by U. S. Public Health Service on the Illinois river to determine definitely the nature of polluting substances and the fundamental laws that operate in stream purification**

An investigation of some phases of the stream pollution problem was inaugurated by the U. S. Bureau of Public Health nearly ten years ago, in accordance with authorization by Congress in 1912. This investigation has included a study of the coastal waters and tidal streams to learn the effect of pollution on the shell fish industry; but studies of stream pollution and stream purification in the inland rivers has formed the most important part of the investigation.

The greater part of the field work has been conducted on the Ohio river and its water shed. These Ohio river studies were interfered with by the war, and no official statement of the information derived from them has yet been published. More recently the studies have been transferred to the Illinois river to determine the general applicability of the fundamental laws observed as a result of the Ohio river work. A brief description of this investigation was given in a paper before the Illinois Section of the American Water Works Association by J. K. Hoskins, sanitary engineer of the U. S. Public Health Service.

He stated that the first object of these studies is to determine the nature of the various important primary types of pollution substances in fundamental terms, and then to ascertain and evaluate the effects of these when discharged into a stream.

Another object is to discover, if possible, the fundamental laws that operate in stream purification. "The observed purification is a progressive process that gives evidence of following definite laws, although these may be complex and not easy of determination. There are many factors that modify the rate of purification and these may be so interwoven as to prevent separate analysis. It is certain, at least, that the old statement, that a flowing stream purifies itself in seven miles, is far from correct. We know that velocity, or time of flow, is a controlling factor, rather than distance. Temperature, both of the water and of the superimposed air, turbulence of the water, and the physical content of the water itself, exposure to light and air, all of these, and others, are factors that affect the rate of purification. Each must be studied under controlled conditions, if sound theories of purification are to be evolved.

"The third object is to determine what agencies are active in the process of stream purification and the significance of the role of each agency in this process. It is necessary to know,

for example, what particular organism or constituent is responsible for a specific, observed change in the chemical composition of the various compounds constituting pollution; what rôle such organism or constituent plays in effecting the specific change, and what the significance is of each of these factors. This is in itself a complex problem, of which little is known. We know, for instance, that in the purification process, the death rates of bacteria are a measure of the rate of purification, but we do not know what that death rate is, to what it is due or what all of the factors are that retard or accelerate it. We believe that the plankton, both animal and vegetable forms, play an important rôle in purification processes, but we know very little about their specific activities and their food habits, or the net effect of the products they generate, such as oxygen. We know that certain classes of organisms break down into simpler forms the organic matter present as polluting substances, but just what these processes are we cannot say. We know that the process of purification depends upon the oxidation of organic matter present, but we know little of the rates at which this oxidation proceeds, or the factors that favor or retard this rate. In the process of purification certain chemical changes take place, but with our present knowledge we have great difficulty in interpreting the meaning of these changes, modified as they are by so many other actual changes."

The work was separated into three main divisions, all of which have been carried on simultaneously. The first division has been conducting studies and experiments on the nature and effect of pollution agencies. Analyses of various classes of industrial wastes and sewage have been carried on to establish, if possible, the relationship between the constituents of the waste and fundamental factors active in the production of the particular waste, regardless of the volume of the waste itself.

The second division has been concerned with the phenomena of stream purification. Detailed data are being assembled dealing with the nature and extent of various kinds of pollution being contributed to certain large streams. Studies are being made of the hydraulics of these water courses, as their velocities of flow and amounts of water contributed by tributaries and other sources of inflow. In addition, laboratories for studying the actual degree of purification being effected at various points throughout their courses are being operated for sufficiently long periods of time to supply reliable data.

The third division of the work has to deal with the effect of intensity of pollution on the public health, principally through the agency of the public water supply. This has involved the study of the present methods of water purification and the efficiencies of such plants under varying pollution loads.

Three phases of the study of the Illinois river now being carried on are hydrometric studies, sanitary surveys, and laboratory analyses of



samples of the river water. The analytical work has followed three principal lines—bacteriological, chemical, and biological. By the first, determinations are made of bacteria growing on gelatine at 20 degrees C. in 48 hours and on agar at 37 degrees in 24 hours and the numbers of *B. Coli* computed by the decimal dilution method. The chemical work is confined to determination of alkalinity and turbidity and the immediate dissolved oxygen; also biochemical oxygen demand, using the dilution method and incubating the sample for five days at a temperature of 20 degrees C. and ascertaining the dissolved oxygen present at the end of this incubation period. "We believe this to be one of the most valuable tests at present in use for indicating the degree of pollution and the rate of purification that may be expected to occur from such pollution."

The biological part of the laboratory studies has been designed to supplement the observations so carefully made by Prof. Forbes in connection with the State Natural History Survey and correlate the present findings with them. Consequently only a small part of the biological field is being touched. Monthly samples of bottom sediment are collected at selected points and the nature and amount of the contents of these various sludge deposits are noted. Weekly samples of plankton are collected from many more sampling stations and these plankton forms are counted, identified and recorded. Special attention is paid to the presence of those forms which, in their processes of development, generate and impart oxygen to the surrounding water, thus influencing the rate of oxidation of the organic matter present.

The data have not yet been arranged in final form so that it is not practicable at this time to draw definite conclusions as to the rates of purification of the river, although the results seem to follow the same general trend as those obtained in the Ohio river work.

#### FUTURE INVESTIGATIONS

At the request of the Surgeon General, Dr. Steven A. Forbes, professor of biology at the University of Illinois, Dr. Edwin A. Jordan, professor of hygiene and bacteriology at the University of Chicago, and Langdon Pearse, sanitary engineer for the Sanitary District of Chicago, have made a joint recommendation as to the plan and policy for future stream pollution investigation work.

These consultants first rehearsed briefly the present status of the stream pollution problem, the lack of power in most of the states to order work constructed under stipulated conditions, the fact that the status and tendency as to the stream pollution problem itself seems to be fairly clear, although in some states no attempt at all is made to regulate pollution by industrial wastes although the indications are that conditions have come to such a pass that even the industries themselves realize that something must be done. It would seem that the states and municipalities may require more full police authority, and more uniform laws and practice.

The consultants, therefore, believe that the Public Health Service has a very definite function to perform in the handling of inter-state problems of stream pollution and the investigation of them and of the underlying principles of stream pollution, sewage treatment, water purification and sanitary science in general; also in co-ordinating the efforts of the various states with a view to securing a definite and uniform policy.

"Our opinion as to the relative prominence of different lines of study is expressed in order of importance as follows:

"(1) Fundamental studies of basic problems leading to results of general application: for example, studies of analytical methods, the laws of oxygen loss and replacement, the laws covering bacterial death rates, laws governing the efficiency of filtration, the efficiency of methods of waste disposal, and the laws governing the removal of colloids, dehydration of colloids, color removal from water supplies, etc.

"(2) Collective studies bringing together scattered observations: for example, assembling from various sources, material relating to stream pollution conditions, sewage treatment practice, water purification, etc., utilizing data available from state and municipal organizations.

"These studies should, if possible, be correlated by enough personal contact, and perhaps laboratory work, to put the methods of reporting and analysis upon a common basis."

In addition they suggest efforts towards standardization of laboratory methods; also a semi-annual review of progress in the fields of sewage treatment, water purification and sanitary science. Efforts to secure co-operation between states in sewage treatment and water purification in connection with inter-state drainage areas, with possible studies of such areas.

Following the studies of the Potomac, Ohio and Illinois rivers, they believe the next step might well be an investigation of the loading of water filtration plants in more detail than in the past, and a study of the relation of sewage treatment to water purification. They might consider standards for water supply and make a beginning in the study of the basic laws covering the chemistry and bacteriology of the treatment of water and sewage.

#### Metering in Charleston

In his annual report for 1921, J. E. Gibson, manager and engineer of the Water Department of Charleston, S. C., gives favorable reports concerning metering. In January, 1921, 98.4 per cent. of the services were metered, and by July 100 per cent. were metered and this percentage continued until the end of the year. Referring to economies made in the operation of the plant he says: "These economies consisted in the installation of meters on all municipal water supplies, thereby enabling the various departments to co-operate with us in the reduction of needless waste"; other economies consisting in repairs to engines, pumps and machinery generally, and the placing of new filters in operation.



Averaging records for the entire year, it was found that 81.1 per cent. of the water filtered and pumped to the city was recorded by the service meters, while for the month of August 87 per cent. of the water pumped was so recorded. "While this is very gratifying, we hope to account for at least 85 per cent. of the water pumped to the city." The total amount pumped during the year was 2,231,750,000 gallons, of which 621,350,000 was used for domestic purposes and 1,186,350,000 was used for industrial purposes.

The average daily pumpage into the distribution system was 6,120,000 gallons, while the average pumped from Goose creek to the sedimentation basins was 6,410,000 gallons. The difference, or 3 per cent., represents water used for washing filters, dissolving chemicals, making steam, cleaning reservoirs, sedimentation basins and clear water basins and other incidental uses around the plant.

### Metering in Augusta

The Superintendent of Canal and Water Works of Augusta, Georgia, J. H. Ferguson, in his report for the year 1921 states that "the report on the operation of the pumping station shows that the meter system has accomplished everything that was expected for it and has proven to be a salvation of

the water works system. Comparing the present year's pumpage with the average of the three years prior to the installation of meters, the pumpage shows a decrease of 48 per cent. This reduction represents water that was absolutely wasted and was an economic crime."

The average daily pumpage for 1921 was 5,030,182 gallons, an average daily per capita of 96 gallons. In 1920 the average daily pumpage was 6,459,696 gallons; in 1919 it was 7,841,800 gallons, and in 1918 it was 8,735,630 gallons. This shows a reduction in consumption in these years of 42½ per cent. in spite of an increase in the number of consumers of 1,055 during that time. At present there are 8,848 meters, of which 515 supply industrial consumers.

The saving in the amount of water to be pumped and filtered does not tell the whole story of economy. During 1921 the running time for the two pumps combined was 8,185 hours or 46.7 per cent. of the total time. This means that the pumping has been brought down to within the capacity of one pump, instead of requiring two pumps to be run, one or both of them on part time and at consequently low efficiency.

In order to keep both pumps in condition, the pumps are run alternately, day and night. This is thought by Supt. Ferguson to be preferable to doing all the pumping at night, operating both pumps together, as there is less pressure on the mains and less wear and tear on valves and packing.

## Pier Construction, Wells St. Bridge

**Large water-tight concrete tail pits for long double-deck bascule span built in cofferdams enclosing multiple deep cylindrical foundation piers sheeted down by Chicago well process**

The long-span two-leaf bascule bridge across the Chicago river at Wells street is the twenty third of the two-leaf bascule type developed by the city engineers. It is a double-deck structure, 268 feet long from center to center of trunnions, carrying two elevated railroad tracks, two street car lines, two roadways between the trusses, which are 41 feet 9 inches apart and 27 feet in average depth, and two cantilever sidewalks outside the trusses at a lower level.

It has a clearance of 16½ feet above water level, permitting small tugs to pass without opening the bridge, and is 231 feet wide between the faces of the substructure masonry on opposite sides of the river, with a navigation clearance reduced to 200 feet by the fenders built outside the masonry. It replaces a swing bridge on the same site that was about 218 feet long over all, including the pivot pier in the center which reduced the channel to two narrow openings instead of the one wide one now afforded. The new bridge was designed and constructed so as to permit traffic to be maintained over the old structure during the erection of the new one.

### SUBSTRUCTURE

Each bascule leaf is about 172½ feet long, and is pivoted about 27½ feet from its shore end on a horizontal transverse shaft or trunnion, supported on massive girders and columns in the tail pit which permit the revolution of the bascule leaf to a nearly vertical position in which the heavily weighted shore end is revolved to the bottom of the tail pit while the river end rises clear of the navigable channel. The tail pits, resembling massive hollow piers, are about 48 feet square and 30 feet deep inside, with walls having a maximum thickness of 10 feet at the base, a minimum thickness of 5 feet at the top, and a floor 6 feet thick supported at an elevation of 31 feet below water level on six cylindrical concrete piers carried down to an elevation of 75 feet below water level. The walls and floors are made of 1:3:5 concrete with 10 pounds of hydraulic lime for every bag of Portland cement.

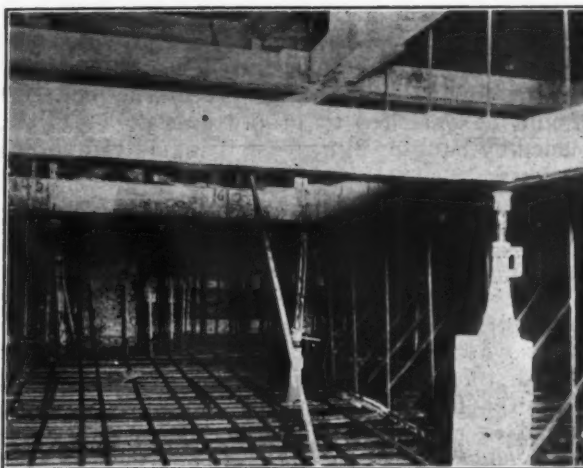
### COFFERDAMS

The tail pits and their foundations were constructed in the open in U-shape cofferdams about 90 feet wide over all transverse to the bridge axis, with the wings extending back from the 90-foot face to the shore. The cofferdam wall

was about 4 feet thick with an inner face of interlocking steel sheet piles 45 feet long and an outer face made with a double line of 3 or 4-inch wooden sheet piles 35 feet long reinforced by round piles 40 feet long, the space between them being filled with puddle.

As the pumping and excavation progressed inside the cofferdam, the walls of the latter were braced by longitudinal and transverse 12 x 12-inch timbers arranged in courses from 4 to 6 feet apart vertically and forming 6 x 12-foot horizontal pockets. The first course was placed at water level, the longitudinal and transverse braces all in the same horizontal plane, one of them being cut to clear the other at intersections and spliced across with wooden scabs. It was supported at intersections by vertical posts which, under the lower course, were replaced by adjustable shores having jack-screws on top that were shifted from time to time to permit the concrete to be placed continuously below them. The total excavation for the bridge amounted to 20,901 yards, of which 2,804 yards was rock and masonry and 2,467 yards was earth excavated from the cylindrical foundation piers. The linear feet of piles required totaled 22,100.

Each tail pit is supported on six concrete cylindrical foundation piers that were at first proposed to be sunk 178 feet below water level to rock bearing, but eventually were seated on hardpan 75 feet below the water surface. These piers are arranged in pairs, one pair supporting the river side of the tail pit, another pair supporting the trunnions, and the third pair supporting the columns. The river piers are 11 feet in diameter enlarged to 19 feet at the bottom; the trunnion piers, 10 feet in diameter enlarged to 18 feet at the bottom, and the anchor piers 7 feet in diameter enlarged to 12 feet at the bottom. All are reinforced with horizontal bars at the base and with vertical bars around the circumference of the shaft. Two piers 7 feet in

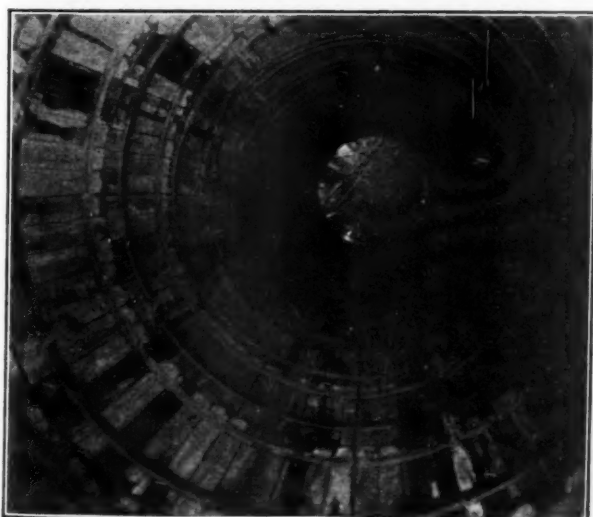


REINFORCEMENT FOR TAIL PIT FLOOR AND WALLS. COFFERDAM BRACING ABOVE SUPPORTED ON JACK SCREWS.

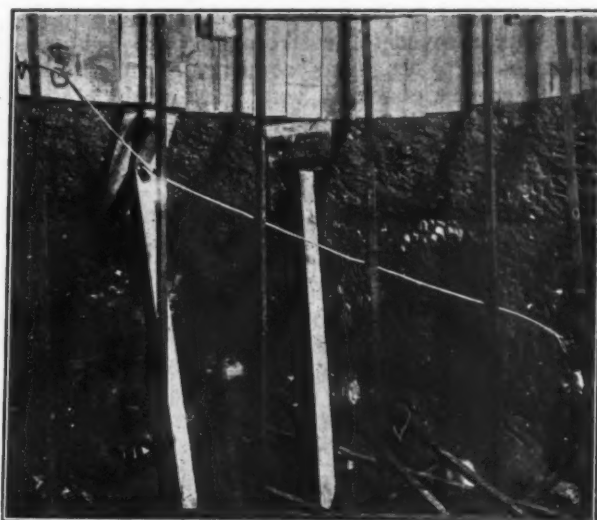
diameter were built to support the abutments beyond the tail pits and two 5 feet in diameter were built outside the tail pits.

All of the wells for the cylindrical piers were excavated by the standard Chicago well method, the earth side being retained as fast as excavated by vertical 3 x 6-inch tongue and groove wood staves, in 56-inch lengths with the edges beveled on radial lines, each section of the lining was braced with two interior steel rings, each made in sections bolted together through inside flanges, and both lining and rings were left in permanent position when the concrete was placed in the well. The contractor was required to supply six iron extensible trench braces with 2-inch screws and radial segment shoes to support the sides of the shaft in case of emergency.

The wells were filled with 1-3-5 concrete spouted to position and deposited in 4-foot courses, each course being carefully leveled and inspected to insure proper consistency, homeo-



INTERIOR OF 11-FOOT FOUNDATION WELL, SHOWING LAGGING AND REINFORCEMENT IN ENLARGED BOTTOM.



REINFORCEMENT BARS ASSEMBLED IN BOTTOM OF 10-FOOT WELL ENLARGED TO REDUCE MAXIMUM PRESSURE TO 8 TONS PER SQUARE FOOT.



geneity, and the accurate positioning of the reinforcing metal. The specifications provided that if clear water more than 3 inches deep appeared on the surface of the concrete, the concrete should be enriched to proportions of 1:2:3 and placed by hand or by the use of modern dumping buckets.

#### CONCRETING TAIL PITS

Steel plates, 12 inches wide, driven with vertical angles 3 feet apart were temporarily placed 6 inches from the inner surface of the wall and shaft forms and the space between them and the forms was filled with 1:2 portland cement mortar placed simultaneously with the concrete to form an outer finish. The steel plates were maintained in position by spacing blocks and were removed as fast as the concrete and mortar were placed.

The bottom of the tail pit floor was heavily reinforced with longitudinal and transverse steel bars with the ends bent up vertically to engage the wall concrete. After these bars had been assembled in position, the vertical shores supporting the interior of the cofferdams were replaced by adjustable struts having jackscrews on top that permitted them to be shifted from place to place as the concrete was deposited, enabling the latter to be applied in a uniform continuous course without vertical holes. As the concreting was carried up, the cofferdam braces were removed to clear it and after the concrete had been placed the sides of the cofferdams were braced against it.

#### WATERPROOF TESTS

After the completion of the tail pits the tightness of the floors and walls was tested by filling the space between the cofferdam and the tail pit with water up to the river level, producing an unbalanced pressure which did not develop any leaks in the concrete. After the completion of the satisfactory tests the cofferdams were removed and the rubble fill dredged out to the original depth. Each course of concrete in the wall was allowed to set from 12 to 24 hours, all laitance, dirt, etc., was removed from the top of the concrete and it was thoroughly cleaned and flushed with water before the next course was applied.

The work was executed by the Fitzsimmons and Connell Dredge and Dock Co., contractors, of Chicago, under the direction of Charles R. Francis, commissioner of public works; William Burkhardt, deputy commissioner of public works; Alex. Murdoch, city engineer; Charles F. Healy, assistant city engineer; Thomas G. Pihlfeldt, engineer of bridges; Clarence S. Rowe, engineer of bridge construction; and F. A. Berry, engineer in charge.

### Freak Stream in Washington

A worthy rival of the famous South American "River of Doubt," which was accused of flowing up-hill, is a stream in southern Washington, accord-

ing to a correspondent—the company special agent at White Salmon. He sends the following report concerning this amazing watercourse:

A small stream called Bear Creek, flowing from the glaciers of Mount Adams, is a freak. It plays hide-and-seek along its course through the forest, slipping into a cave here, a crevice there, then reappearing below a full-fledged rivulet. Its bed is ice-coated nearly the entire year; on the surface rocks float, in the water logs sink.

The water is bright yellow in one place, red in another, and like bluing where it flows into the Columbia River.

Bear Creek, differing from other streams, freezes at the bottom first instead of at the surface. This is caused by a rocky formation, similar to a corrugated washboard, retarding the movement of the water, forcing the surface to move more swiftly. In this way air-bubbles, carrying freezing temperatures, are shot downward and ice forms. Often in winter the stream flows on the surface while the bottom is solid ice.

This freak creek also contains less water in one part of it than in another as you follow its downstream. A four-foot depth quickly becomes a tiny brooklet by the water disappearing into the porous volcanic bedrock; later it reappears and resumes its course.

The logs that readily sink are a species of black-jack pine with specific gravity heavier than water. They are carried into the creek by landslides.

Rocks seen floating are a sort of pumice, or lava clinkers, released by melting glaciers.

The yellow color is direct from the glaciers; the red is caused by red clay bluffs, and the blue by a deposit of copper quartz through which the stream has cut its bed.—From "Standard Oil Bulletin."

## Rainfall Intensity Curves

In connection with designing storm sewers for the city of New York, records of rainfall are used which are considered to serve better as a basis for prognosticating the frequency of high intensity rainfalls for the entire city than can be obtained in any other way. These curves are based upon a series of observations covering 52 years, believed to be the longest continuous record in existence.

"The Municipal Engineers of the City of New York" published in 1913 a series of curves showing the intensity of rainfall for different durations and frequencies based upon the records of the Central Park (New York City) self-registering rain gauge from January 1, 1869 up to that time. These curves have been revised by Kenneth Allen, sanitary engineer for the Board of Estimate and Apportionment, to include all the records up to the close of 1920. These revised curves are shown in the accompanying diagram.

It will be noted that these show intensities of rainfall in storms that may be expected to occur once in five years, once in ten years, fifteen years, twenty-five years, fifty years, one



hundred years, and finally a curve of absolute maximum.

The formulas for these curves are as follows:

$$\begin{aligned} \text{Absolute maximum, } I &= \frac{74,000}{(T+80)^2} \quad 100\text{-year curve,} \\ I &= \frac{354}{(T+24)^{1.1}} \quad 50\text{-year curve, } I = \frac{186}{T+17} \quad 25\text{-year} \\ \text{curve, } I &= \frac{78}{(T+11)^{0.84}} \quad 15\text{-year curve, } I = \frac{47}{(T+8)^{0.78}} \\ 10\text{-year curve, } I &= \frac{43}{(T+8)^{0.78}} \quad 5\text{-year curve,} \\ I &= \frac{25}{(T+4)^{0.67}} \end{aligned}$$

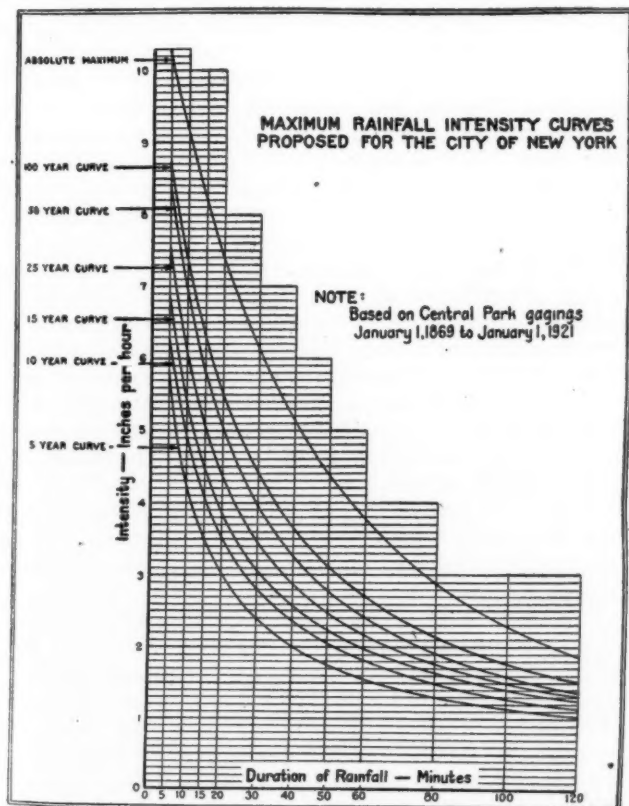
A casual inspection of this curve will indicate how much more expensive would be a system of storm sewers designed to absolutely prevent any flooding of streets than would be one which might be expected to cause flooding by inability to handle storms once in five or ten years. For instance, if we assume a system draining an area such that it would require thirty minutes for rainfall to flow from the furthest part of the area to and through the sewer system to the lowest part of the area, we find the absolute maximum rate of rainfall in inches per hour for that period would be more than  $2\frac{1}{2}$  times as great as that occurring once in five years. Knowledge of run off has shown that the percentage of rainfall running off is greater with the higher rates of fall, and consequently the sewer capacity would need to be possibly three times as great. If we take a smaller area, one for instance that could be drained by a flowing time of ten minutes from the upper to the lower

boundary, we find a ratio of only two and one-sixth; while for eighty minutes, the ratio again is about two and one-sixth. The cost of the sewers, of course, would not increase as rapidly as their capacity, but the cost of the larger ones might be roughly estimated at 50 per cent. greater than the smaller.

More reasonable would be a design based on the fifty or twenty-five year curve. If we take the twenty-five year curve, we find that on a thirty-minute flow-off area the capacity would need to be only 40 per cent. greater, and the cost possibly 20 per cent. It might very conceivably be considered economical from a purely financial standpoint to increase the cost of a storm water system by 20 per cent. if by so doing we could reduce the number of storm overflows causing damage to basements and public as well as private property from twenty times a century to only four times a century. In fact, 40 per cent. is not an unreasonable factor of safety, in view of the inaccuracies of calculation of flow in conduits, the possibility of deposits in the sewer, etc. The use of the fifty-year curve, equivalent to a factor of about 1.7, or even a one-hundred-year curve, equivalent to a factor of about 1.8 (these are all based on thirty-minute durations) might easily be considered justified.

## Street Illumination\*

Recent practice in selection of posts and lighting units for various city conditions.



High mounting of lamps (13 ft. to 20 ft.) is generally adopted on downtown business streets and important boulevards where exceptionally high intensities are required. Under these conditions it is desirable to select a unit which will control the direction of the light either by the use of refracting glassware or by specially designed reflectors.

Lower mounting heights are usually adopted for residence streets in order to place the light source below the foliage of trees lining the sidewalks. In this case, lamps of lower power enclosed within diffusing glassware are used.

### ORNAMENTAL STREET LIGHTING

The trend of street lighting practice is toward a system of lighting which will add charm to the streets of a city by day as well as illuminate effectively the streets by night. The unsightly overhead equipment is being rapidly replaced by underground cable construction and ornamental posts supporting specially designed lighting units.

Manufacturers of street lighting equipment have developed in the last few years many interesting designs possessing unusual artistic merit which will be found suitable for the varying conditions which exist in different parts of a city.

\*Abstract of a paper by L. A. S. Wood, manager of Illuminating Section, Westinghouse Electric & Mfg. Co., before the International Ass'n of Municipal Electricians.

For important boulevards or exceptionally wide business streets two-light or "Duplex" posts may be used, and ornamental posts of this character add considerably to the attractive appearance of a boulevard. For downtown business streets a variety of single-light ornamental posts is offered from which a selection may be made of posts which will harmonize with the surrounding architecture.

On streets where steel poles supporting trolley span wires are advantageously placed, the steel poles may be used as supports for ornamental lighting brackets, thus eliminating the necessity for cluttering up the street with additional posts.

#### CAST IRON, CONCRETE AND PRESSED STEEL POSTS

In selecting ornamental street lighting equipment a unit should be selected which, while effectively illuminating the streets at night, will be inconspicuous in the daytime, blending harmoniously with the architecture of the surrounding buildings. Since the purpose of the ornamental post is to support the light unit, a slender design is preferable to one of massive appearance. The durability and lasting qualities of the post should also be considered, and experience has shown that a cast iron post, manufactured from a mixture of iron possessing a high tensile strength, is the most suitable for the conditions which prevail on the streets of our cities.

Ornamental lighting standards are also made of concrete and of pressed steel, both of which possess merit. While concrete is probably one of the most durable materials used in building construction, it will be found that concrete posts, unless manufactured with the greatest care and of massive construction, will not withstand the extremes of climate such as are prevalent in the northern sections of the country.

Pressed steel posts which consist of a rolled, fluted steel column with cast iron base and capital—all held together by tie rods—are of necessity massive in appearance and subject to serious injury from the shocks of collisions which would leave a cast iron post undamaged.

#### LIGHTING UNITS OR POST TOPS

Lighting units or post tops may be divided into two classes:

1. Those designed to diffuse the light and in which the light source is invisible (used for low mounting).
2. Those designed to direct the light into the plane of illumination with maximum efficiency (used for high mounting).

There are several types of diffusing glassware in commercial use, and care should be taken in the selection of a type of glassware which will thoroughly diffuse the light without an undue absorption. A satisfactory glassware with an absorption of from 9 to 15 per cent., through which the filament of the lamp is invisible, may be obtained.

The use of refractors alone to direct the light into a definite plane has been limited to large candle-power, single-light sources, mounted high on ornamental standards; and, where refractors

are placed at lower heights, it is necessary for optical comfort to use an outer globe to soften the brilliancy of the light source.

In addition to refractors the light may be re-directed by reflectors, as in a recent development known as the "Reflecto-lux." With Reflecto-lux ornamental lighting units the distribution is obtained by upper and lower parabolic reflectors which direct the light outward. The glare from the lamp filament is softened by flashed opalescent glassware, specially designed to impart a sparkling effect to the light.

#### Typhoid Fever From Clams

The State Department of Health of Connecticut in a recent bulletin reports an outbreak of typhoid fever totalling eighteen cases, seven of the cases appearing to have been caused by the eating of clams contaminated by harbor pollution. These clams had been stored in the Quinnipiac river, which is grossly polluted and which some years ago had been considered to be the cause of infection in typhoid outbreaks in that State.

## Toledo Water Works Notes

**Collecting water by zones. Pumping efficiency. Deposits on filter sand. Cleaning mains. Mechanical equipment. Metering.**

#### WATER RATE ZONES

In the introduction by W. T. Jackson, Director of Public Service of Toledo, Ohio, to a report for the year 1921 of the Division of Water of that city, he states that he believes the method of collecting water bills "should be immediately changed so that the city may be divided into zones or districts and bills be sent out semi-annually in order that a constant income be forthcoming instead of two annual congestions of water users at the City Treasurer's office as is now the case. This would enable a regular routine of work being maintained constantly and at the same time the Division of Water would always have sufficient funds to properly conduct its financial affairs."

This expression of opinion endorses a part of the report of Frank Miller, water commissioner, in which he says: "Operating revenues are collected monthly and semi-annually, the monthly collections during the year equalling approximately both semi-annual collections, or as \$514,000 is \$500,000 for the past year. General operation expenses, which are exceptionally heavy during the first six months of each year, create temporary deficits which are not absorbed until late in the year. One of two things is necessary to overcome this condition, namely, the establish-



ment of a stabilizing or reserve fund of at least \$200,000, or else the more frequent collection of revenues. The latter would be the most logical, as its advent would seem to permit of more economical operation. A plan whereby the city could be arranged in say four zones of from 10,000 to 15,000 accounts in each zone, would provide operating revenues for current use in the amount of \$125,000 or more every three months. This, it is felt, at the same time would reduce the field force required, with the possible exception of a small increase to the office force to carry out the suggestion."

#### PUMPING EFFICIENCY

Approximately 10 per cent. more water was pumped per pound of coal used during 1921 than the previous year, and the same percentage of increase in efficiency was obtained for the overall station duty. Great care was exercised in the purchase of coal and a very high quality of coal was obtained and at a reasonable cost. Another cause of increased efficiency was that the operation of the engines was conducted under definite procedure, the older and less economical units having been operated less frequently.

Performance tests were made of each pump, and combination tests developed certain efficiency ratings for combinations of pumps at various rates of pumpage. With the use of new equipment which has just been installed in the boiler room it is believed that still greater results and improved efficiency will be obtained.

#### FILTER SAND

It was reported that all the filter units would need to be resanded this year, since in a considerable number of them the effective size of the sand was considerably in excess of that of the sand first installed and which is considered desirable. The finer sand has been lost during the several years of operation of the plant by being carried over with the wash water, or else has increased in size due to deposits on the individual grains caused by the chemicals used; this latter being due to a great extent to incomplete chemical reaction in the sedimentation basin, the capacity of which is recognized to be too small.

This deposit is apparently due chiefly to the treatment with iron sulphate and hydrated lime. This treatment was used exclusively during January and a part of February "with the result that the sand incrustation increased to 39 per cent. although a modified treatment was used. For the remainder of February, the entire month of March and two weeks in April, aluminum sulphate was substituted, which treatment effected a reduction of the incrustants to 30 per cent. For a part of July, the entire month of August and a portion of September, alum was again used for the purpose of further removing the incrustation from the sand and to assist in the elimination of growths which occurred in the sand during the early summer. The last two weeks in December aluminum sulphate was again substituted, to be continued through the cold months. During the remainder of the year iron sulphate and calcium hydrate were used."

Owing to this heavy deposit of incrustants during the winter of 1920-21 the filter efficiency was greatly lowered and the sand became of such size as to prevent the proper washing of the filters. The alum treatment, which was begun in February, "removed a portion of this coating and rendered the remainder semi-porous. Upon again changing to the iron-lime treatment in May, a cementing action was started which was not thoroughly broken by washing of filters and, aided by the porosity of the sand incrustations, entrained sufficient organic material to become heavy and later start the formation of mud balls in two of the filters. There was no surface indication of this, which caused considerable trouble in July. Large quantities of Bryozoa deposited on the sides and wash troughs necessitated daily cleaning and scrubbing to effect their removal."

The amount of aluminum sulphate used varied from a maximum of 696 lbs. per million gallons in March to a minimum of 237 lbs. per million gallons in August. The iron sulphate used varied from a maximum of 606 lbs. per million gallons in April to a minimum of 223 lbs. per million gallons in July; the amount of hydrated lime used during the same two months being 522 lbs. per million gallons and 225 lbs., respectively.

#### CLEANING MAINS

A contract had been entered into with the National Water Main Cleaning Company for cleaning a 12-inch secondary feeder for a length of 5,000 feet. This line had been in service thirty-one years and before cleaning was flowing at the rate of 792,000 gallons per day with a loss of head amounting to 34.5 feet in five thousand feet. After cleaning, with the same rate of flow, the loss amounted to 2.15 feet per thousand feet, which means that the same amount of work was accomplished with a decrease of fourteen pounds in pumping head; or with the same amount of pumping energy exerted, the line would have delivered at the rate of 3,160,000 gallons per day; or more than three times as much as before it was cleaned.

In connection with this work a calculation was made showing that the annual cost to operate 5,000 feet of this line before cleaning, based on coal costs at the Broadway station, was \$262.20, which was reduced to \$16.34 after cleaning; or an annual saving of \$245.86. "Should we have reinforced the supply along this street in proportion to the gain in capacity made by cleaning the present line, we would have had to duplicate the present line at a cost estimated to be \$14,900 (5,000 feet), interest on this at 5 per cent. would amount to \$745; this plus operating costs previously mentioned makes a total annual saving amounting to \$990.86. The cleaning of 5,000 feet of this line, our attendant expenses included, amounted to \$1,075; therefore in slightly more than one year's time this entire expense will have been assimilated.

#### MECHANICAL EQUIPMENT

"With the idea in mind that much of the work contemplated to be done within the next four years will be done by departmental forces, it



would seem desirable from the standpoint of facility and economy to purchase more mechanical equipment than is now available for use. Such would include trenching machines, power back-fillers, pavement breakers, air compressors for pneumatic calking, pipe derricks and auto trucks of much larger capacity especially equipped for the handling of large size pipes and special castings. Most metropolitan water works have within the last few years accumulated much of such equipment, notably Baltimore and Detroit.

"An emergency crew consisting of two men per shift of 8 hours each is now available between the hours of 3 p. m. and 7 a. m. for answering all trouble calls, responding to fires, etc. They are furnished with a specially equipped truck upon which is a full complement of tools necessary in taking care of troubles of almost every nature. It would be advantageous to the Fire Department as well as this division to have the fire alarm telegraph installed in the location where this truck is quartered, so that all large fires may be responded to and have this crew on hand in case of necessity."

#### METERS

During 1921, 1,881 new service branches and 2,805 meters were installed. There are now 52,840 services available for use, of which 46,802 are metered, or 88.6 per cent. Revenues derived from the large meters in the system were decidedly lower last year than any previous year owing to general business depression, and special attention has been directed towards the condition of them. A certain number of the velocity type of meters have been compounded and this has resulted in increased revenue from every service where it was done. The water commissioner, therefore, believes that compound meters should be installed more generally and that every velocity meter in the service which undergoes severe fluctuations should be compounded. In line with this policy, meter specifications have been revised to the extent that all meters four inches and over in size must be compound meters, those below being of the disc type.

#### Manholes for Valves and Meters

In New Orleans all valves are systematically inspected and tested by actual operation. Each is numbered and a permanent record kept of the results of the inspections. No one is allowed to open or close a valve except an emergency turn-off man, and except under unusual conditions the same man who closed the valve is sent out to open it again. This rule, of course, does not apply to the valve and hydrant inspection and repair forces.

When it becomes necessary to repair a valve in a paved street, a manhole is built around the valve to avoid cutting the pavement for future repairs, and manholes are built over valves in advance of new street pavements.

During the year 1921 the water maintenance office repaired 684 valves, moved 5, removed 5,

inspected 4,434, readjusted 418 boxes and built 251 manholes.

In addition to valves, manholes are also built over large meters. During the year the department put in 69 cast-iron services of 4-inch to 8-inch pipe, and with them 56 meters of the same size. It is proposed to place meters as quickly as possible on all unmetered services, using manholes at all meters.

The department is equipped to test and repair about 15,000 meters per year and during 1921 repaired and retested 10,531, besides testing 483 new meters and repairing 600 large 2-inch to 12-inch meters in place.

#### Public Utilities During the Coal Strike

Figures for the average daily production of electricity by public utilities plants apparently show that the strike had little effect upon the total amount of power produced by such plants. They also indicate what effect the coal shortage had upon the use of other fuels. Curves showing daily production of electricity for 1920, 1921 and 1922 are very similar in appearance, there being a continuous and approximately uniform decline in quantity from January to May, an appreciable rise in June, a decline in July to a little above the May figure and then a continuous rise until November. In the 1922 curve the Spring decrease stopped in April and there was an increase in May rather than a decrease. In that month the k. w. h. totalled about 115 millions in 1920, about 106 millions in 1921 and about 124 millions in 1922. In June of these three years the production increased two million, three million and four millions k. w. h., respectively, and in each fell again to within less than a million of the May figure.

It is seen, therefore, that, although the production of electricity in the spring of 1922 was nearly 20 per cent. greater than in 1921, the coal strike had no appreciable effect upon it. Part of this was undoubtedly due to the fuel that had been stored by the utilities beforehand. But turning to other figures compiled by the U. S. Geological Survey, we find that the amount of natural gas consumed increased from about one and a half million thousands of cubic feet in March to two and a half millions in July, although the total production of electricity was approximately the same in the two months. Moreover, the July consumption of natural gas was approximately 10 per cent. greater than the June consumption although the electricity fell off about 2-1/2 per cent. between those two months. Fuel oil also apparently aided to make up the deficiency, since the July consumption was nearly 5 per cent. greater than the March consumption and nearly 9 per cent. greater than the June consumption. Water power apparently played no part in meeting the coal deficiency, presumably because this was impracticable without the construction of additional hydro-electric units, for which the time was too short. In fact, the amount of water power used decreased to a greater extent in the summer of 1922 than in either 1921 or 1920.

# PUBLIC WORKS.

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### Society Conventions

We give to our readers this month reports of the conventions of two societies that concern themselves with municipal public works—the American Society for Municipal Improvements and the New England Water Works Association.

The former society, although with comparatively small membership, has long exerted a greater influence in improving the character of

such works than any other organization, one proof of this being the fact that its street paving specifications have for several years past been the accepted standards.

The N. E. W. W. Association, although sectional in name and origin, has become national to some extent in its membership and to a greater extent in its influence. Its form for reporting water works statistics is more widely used than any other, and its specifications and standards for cast iron pipe were the first to receive general acceptance and use by both superintendents and manufacturers throughout the country.

Many of the members of these societies were unable to attend the conventions (railroad fares are very high these days), and the publication by the societies of the official records of them will probably be postponed for several months. We, therefore, believe that the majority of our readers will welcome a narrative that tells of the most important doings and gives briefly the high points of the facts and opinions brought out in the papers and discussions.

It is not pretended that such a description is a satisfactory substitute for attendance at a convention. Only by being present in person can a member apprehend the mental attitudes of the speakers, which is often necessary for a correct interpretation of their words. Even more important is the mental stimulus to render better service, the renewal of pride in the importance and honor of such service, the broadening of mind and many other benefits to be derived from personal contact with men from all parts of the country who are performing similar work and meeting similar difficulties, and the pleasure of renewal of old friendships and making of new ones. These are things that no printed words can give. We have confined our efforts to recording for the benefit of our readers the bare facts and opinions expressed at the meetings, and hope that they will consider them worth while.

### Tests on Tight Sewer Joints

The tests on the use of bituminous material for making water-tight joints between vitrified clay sewer pipes which were described in the September issue are of interest to sanitary engineers, but seem to us to be of little practical value. They demonstrate that joints can be made with this material that will be water-tight under a head of 10 or even 20 pounds pressure. But in order to secure this result the pipe and the oakum packing in the joint must be perfectly dry and the material used for the joint must be at a temperature of more than 350 degrees at the moment of pouring. While the latter condition perhaps is not difficult to secure if a reliable man is in charge of this part of the work, the securing of absolute dryness in a trench the bottom of which is below groundwater level is a condition not so easily maintained continuously throughout the laying of the pipes.

There may be some sewerage systems or sections of systems where an internal pressure of 10 or 15 pounds is exerted against the joints, but ordinarily there is practically no pressure exceeding the few



ounces due to the depth of sewage above the invert of the pipe. What is needed for practical sewer work is not a joint that can be made to withstand 10 or 15 pounds pressure under ideal construction conditions, but one that can be made tight against 10 or 15 ounces pressure when made under the conditions ordinarily encountered in wet trenches.

The tests referred to show plainly that the ordinary cement and sand mortar joint meets all requirements if it can be made under the proper condition and this maintained for 24 hours, this condition being that the cement should remain unmoved in the joint until it is set. The weakness of the cement joint is due to the difficulty of maintaining this condition. Even though the most skillful and conscientious employee be used to make the joint and insure that the mortar is well compacted into and built up around the bottom of the joint as well as the sides and top, if water is allowed to rise onto the joint before the cement is set the mortar will become soft and settle away from the pipe even if it does not entirely slide out of it at the bottom of the joint.

We believe that much tighter joints can be made in sewers with bituminous material properly employed than with cement used under practicable conditions in very wet trenches, but it does not seem to us that the tests above referred to have developed any information which will aid in securing such results.

It seems to us that more profitable experiments would be a series made with a view to developing a procedure for using these bituminous materials or others in a wet trench so as to obtain tightness under 2 or 3 pounds pressure from the inside, or 5 or 10 pounds pressure exerted on the outside of the joint. It is possible, for instance, that instead of oakum which, when once wet, cannot easily be dried, some non-absorptive material could be used to prevent the bituminous material from flowing into the pipe, or some construction of pipe or other procedure be developed which will not require the use of any such material. With the packing dry, it should not be difficult to thoroughly dry the surfaces of the bell and spigot just before pouring the jointing material. An advantage of the bituminous material for joint cement is that it is not injured by water contact once it has been poured into place, and it is therefore necessary to keep water away from the bell for only the two to five minutes required for placing the pipe and pouring the joint.

### Reciprocity in Registration of Engineers

The Council of State Boards of Engineering Examiners representing sixteen States met in conference on Oct. 2nd and 3d, and agreed upon rules for the reciprocal registration of professional Engineers. The rules adopted provide that an engineer registered in one State may be permitted to practice in other States that are parties to the reciprocal registration agreement. The articles of agreement will become operative as rapidly as they are signed by the various State Boards and Engineering Examiners. The several State boards are urged to endeavor to have their State laws changed where necessary so as to allow an engineer going into another

State to practice under reciprocal registration without the payment of another fee.

The articles of agreement contain a number of specifications as to requirements for registration, included among which are that professional experience shall not be considered to have begun before the applicant has reached his eighteenth year, nor before entering upon a position in professional engineering work that required original thought and responsibility. An applicant for registration must have had ten years of such experience, and, in addition, show that he is qualified to design as well as to direct engineering operations, and "his experience record shall show progressive advancement in the character of the work performed"; graduation from an engineering school being equivalent to four years of such practice.

Certification from one State to another shall be by means of a card or form, bearing date, serial number and signatures of the officers and seal of the Board. An applicant for reciprocal registration must be granted the same if his qualifications fully comply with the standard above described. A reciprocal certificate may be revoked by the State issuing it on "good and sufficient evidence of incompetence, or that the applicant's character warrants such revocation."

### Salaries for Sanitary Engineers

In our issue of July 15th, in commenting upon the salaries received by sanitary engineers in the Public Health Service, we stated that after twelve years of service, officers might be promoted to the position of Associate Sanitary Engineer, carrying a minimum salary of \$3,920. We have been informed by Isador W. Mendelsohn, assistant sanitary engineer in the P. H. S., that after twelve years promotion may be had to the position of Sanitary Engineer, carrying a minimum salary of \$4,550 and a maximum of \$5,450.

We are glad to learn that salaries are obtainable more nearly commensurate with the ability and standing that should be required of men filling these important Federal positions. The figures given by us were our understanding of the statements made in the official circular announcing civil service examinations for positions in the P. H. S.

### Sewage Treatment for Trenton

The Commission of Trenton, N. J., has adopted a report made by Col. George A. Johnson on the matter of sewage disposal for that city, in which he recommended the installation of a direct oxidation plant with a capacity of thirty million gallons per day, and has directed him to proceed at once with the preparation of plans and specifications. The report was delivered to Trenton on September 19th. It embodies the results of a six weeks' test of the Allentown direct oxidation plant, which is also described by the city engineer, H. F. Bascom, in a paper before the American Society for Municipal Improvements, which we expect to publish next month.



# American Society for Municipal Improvements

**Narrative of the Convention held in Cleveland October 2nd to 6th; the business transacted and the papers read and the discussion of them**

The twenty-eighth annual convention of the American Society for Municipal Improvements, held at the Hollenden Hotel, Cleveland, on October 2nd to 6th, demonstrated the maintained interest in the society which is entertained by the municipal engineers and other officials of this country. Representatives were present from Northern cities extending from Portland, Oregon, to Boston, Massachusetts, and Southern cities from Houston, Texas to St. Petersburg, Florida. More than 350 registered at the Secretary's office, which indicates an attendance of probably about 400.

One rather unusual and very commendable feature, for which President Rankin deserves credit, was the promptness with which the sessions were begun, and the fact that the printed program was adhered to almost exactly from start to finish. In addition to the sessions held for the reading and discussion of technical papers on Tuesday, Wednesday, Thursday and Friday, Monday afternoon and evening were fully occupied by the meetings of a number of the committees, especially those on specifications. During the convention there were presented in a room adjacent to the convention hall a very fine exhibition of materials and appliances used by, or useful for, the public works of municipalities.

There was being held at the same place a convention of the Ohio State Conference on City Planning during Monday and Tuesday, and on Monday and Tuesday evenings joint sessions were held by the two societies.

At the business meeting on Thursday morning Memphis, Tenn., was chosen as the place for the 1923 convention. Invitations had been received from several other places including Montreal, Washington, D. C., and Louisville, the last-named being active with literature in its efforts to secure the next convention. Atlanta, also, sent an invitation, but later withdrew its request for this year, expressing the hope that it would be given favorable consideration for 1924. The committee, in reporting upon the several invitations, gave, as its reason for recommending Memphis, that it seemed desirable to hold next year's convention in the Middle Southwest.

At the same meeting the officers were elected for next year, resulting in the selection of W. W. Horner of St. Louis as President, E. R. Dutton of Minneapolis as First Vice-President, Herman H. Smith of New York City as Second Vice-President, E. L. Dalton of Dallas, Texas, as Third

Vice-President, Robert Hoffman of Cleveland as Treasurer, and Charles Carroll Brown of St. Petersburg, Florida, as Secretary.

The only other society business transacted at the meeting was the adoption of amendments to the Constitution at the recommendation of the Executive Committee. It had been generally recognized that a double mistake was involved in including in the present Constitution of the society a long list of fixed committees, both because this list was so long as to be burdensome, and also because it did not seem desirable to have the list included in the Constitution, since it might seem advisable to add new committees, or drop old ones, from time to time. An amendment was adopted by the convention to be sent to letter ballot by the entire membership providing for removing this list from the Constitution and giving to the Executive Committee the power to determine what committees should be appointed from year to year.

Another constitutional amendment was one providing that engineers of public utilities should be eligible for active membership in the society. In the past it has been necessary by the Constitution to admit them only as affiliated or associate members. These two amendments will, as required by the Constitution, be submitted to the entire membership during the coming year.

## TUESDAY'S SESSIONS

The convention was formally opened at 10 A.M. Tuesday, by an address of welcome delivered by Ray Miller, representing Mayor Fred Kohler, and responses by the President of the Ohio State Conference on City Planning and by W. W. Horner, First Vice-President of the A. S. M. I. This was followed by a brief address by Robert Hoffman, Chairman of the Convention Committee.

Edward S. Rankin, President of the society, then delivered his annual address. The President touched upon the advantage to the society of having in its membership officials other than city engineers; the desirability of higher salaries for city engineers; the desirability of having more contractors among the associate members, together with the advantage of retaining in such membership the material men, so-called; making a plea for co-operation between the engineer, the material man and the contractor in securing the best possible results in municipal public works. He suggested that the four points

of the star which forms the design of the society's pin, represented the four elements of membership—the municipal executives, the engineers, the contractors and the manufacturers.

Following the President's address, the Executive Committee reported, the principal features of this being the recommendation that the society adopt the constitutional amendments already described.

The Secretary rendered his report for the year, showing the membership changes and the accounting for cash received by him. The active membership during the year showed a net increase of seventeen, with 500 members on August 31, 1922. The affiliated membership showed a loss of three, with thirty-two members at the date named, while associate membership showed a net gain of one, being 131 at the end of the year; giving a total of 663 members on August 31, 1922. The finances, since the convention was earlier this year than last, covered a period of only eleven months, which showed its effect in somewhat smaller receipts; in addition to which the fact that the misfortunes of the firm that printed the Proceedings had so greatly delayed their appearance that the collections for the advertising therein had not all come in. Membership dues for the eleven months totalled \$3,508; from Proceedings sold, \$144.55; from Specifications sold, \$8.25; from advertisements in Proceedings, \$423.81; from miscellaneous, \$1.82; giving a total remitted to the Treasurer of \$4,086.43. In round numbers, the expenditures totalled \$940 for office and miscellaneous, \$1,067 for convention expenses, \$1,210 for the 1920 and 1921 Proceedings, \$192 for printing Specifications, \$85 for letter ballots, \$300 for Secretary's salary, \$360 for committee expenses, and \$29 for clearing house expenses. The Secretary reported that the delay in printing the Proceedings was explained by the printer as due to a storm which destroyed the wires through which he obtained power for his plant (which is located in a small town) and a subsequent epidemic which practically closed his printing house; although even with these handicaps there seemed no excuse for his not finishing the work two or three months earlier than he did. Arrangements have been made with another printer for this year's Proceedings, and he promises to place upon the shoulders of the Secretary any blame for delay in getting them out.

At this meeting a Committee on Nominations was appointed consisting of Messrs. Tillson, Howell, Pierson and Kingsley; Committee on Place of Meeting, consisting of Messrs. Compton, Corson, Barnes, Near and Kingsley; and a Committee on Resolutions, consisting of Messrs. Hatton, Conant, Pollock, Reimer and Sprague.

The usual gathering of a large percentage of the Past Presidents of the society, which has been one of the remarkable features of this association at every convention, lacked one of its faithful attendants—ex-President Fred Giddings, whose health did not permit his attending, and the society sent him a telegram of greetings.

The report of the Committee on Fire Prevention, presented by Alcide Chausse, had been printed in the advance papers, and was read by title. A paper which it had been intended to present on Thursday describing the Selo Process of Sewage Treatment, was read by the Secretary, this being one of only two changes in the program.

On Tuesday afternoon A. V. Ruggles, Commissioner of Water of Cleveland, gave a brief description of the Cleveland water supply. Owing to the considerable elevation of parts of the city, the distribution system has been divided into a low service and a first, second, and third high service, the last serving elevations some of which extend to 800 ft. above the lake, and the second high service serving those between 250 and 500 ft. At five points the water mains are carried under the river in tunnels, while at a sixth the main crosses the river but not in tunnel. The supply is obtained from the lake through two inlets. That received through the west side tunnel is filtered. That through the east side tunnel is not filtered but is treated with chlorine, but a filter at this point is now under construction. The water works system serves an area of about 475 square miles, in which it is estimated that there will be a population of one million six thousand people by 1940. The consumption at the present time is about 135 gallons per cap. per day, about 60 per cent. of which is industrial.

In the absence of the Chairman, the report of the Committee on Municipal Legislation and Finance was read by the Secretary of the society. This report gave a resume of changes during the past year, prominent among which were the additional financial difficulties thrown upon the cities. Increased pay to the police and fire departments was accountable for a considerable part of this. This increased expenditure resulted in corresponding increases in the tax rates and in assessment valuations. A number of cities have provided additional sources of revenue, including new classes of permits and of taxes, such as automobile fees, taxes on gasoline and sign boards, a more general assessment against abutting property for public improvements, etc. There was also evident a commendable effort toward increased economy, a number of cities have established purchasing departments with this end in view. In the matter of legislation the committee called attention to the growth of the idea of Home Rule for Cities, reducing the number of officials, direct primaries, non-partisan ballots, etc. The rapidly increasing popularity of city planning also was referred to.

Dr. A. R. Hatton then read a paper entitled "Should Municipal Administration Be Professionalized?" in which he strongly emphasized his belief that every man from the bottom to the top in every branch of municipal administration should have been professionally trained for the municipal work in which he is engaged. Even a training along the same general line is not sufficient; bankers, for instance, being frequently very poor advisers on public finance, which is an



entirely separate branch of business. This paper was discussed by Messrs. Lewis and Durham who brought out some further explanations of the author's opinion.

The report of the Committee on Water Works and Water Supply had been published in the advance papers and was down for a discussion at this session, but in the absence of Mr. Fuller, the Chairman, the discussion was postponed until a later session. The session closed with a paper on athletic fields and stadiums by Arthur Leland, of the Committee on Park Systems and Open Spaces. In this he gave a large amount of exact data concerning dimensions and other requirements for baseball diamonds, football grounds, soccer, lawn hockey, lacrosse, tennis, golf, quoits, coasting and other sports.

The evening session, which was held jointly with the Ohio State Planning Conference, was opened with a report by Nelson P. Lewis as Chairman of the Committee on City Planning, this report being in the form of a paper on regional planning. After giving some facts concerning regional planning as adopted or under consideration by different cities and districts, Mr. Lewis described the work being done by a committee which is supported by the Russell Sage Foundation in preparing the greatest regional plan ever considered—that being made for New York City and adjacent area in three States, covering about 5,500 square miles. This explanation was made more interesting and intelligent by the free use of lantern slides showing maps and diagrams which presented clearly the exhaustive studies which the committee had made into every phase of commercial, industrial, and social life affecting the problem, geography, topography, transportation, and the many ramifications of the subject.

Following this a description was given by a representative of The Fairchild Aerial Camera Corporation of the work which it does in making aerial surveys. A number of photographs taken by this company had been shown by Mr. Lewis in order to give more clearly in a few general views an intelligent idea of the territory covered by the New York regional plan. The photographs shown could be generally classed as bird's-eye views and scale maps, the latter being taken vertically and at a uniform elevation so that they represented an exact scale. For instance, several dozen such maps were shown fitted together so as to form a map of Manhattan Island, New York, on which could be seen every building and even the traffic moving in the streets, all to an exact scale.

A paper on Control of Property Sub-divisions was read by E. A. Fisher, Superintendent of City Planning of Rochester, and one on the Treatment of Intersections of Heavily Travelled Traffic Arteries, by Clarence Farrier, was read by the Secretary; and a report of progress was presented by J. M. Rice as Chairman of the Sub-committee on Park Systems and Open Spaces. A discussion of these three papers was taken part in by Mr. Wynne-Roberts of Toronto, and

others; following which G. J. Requardt of Baltimore read a paper discussing the treatment of garages in the various zoning ordinances adopted, in which he called attention to certain restrictions to public garages and definitions of the distinction between public and private garages which seemed to demonstrate the necessity for some modifications of these features of zoning ordinance, which paper was discussed by J. C. Grenalds of Baltimore.

#### WEDNESDAY'S SESSIONS

On Wednesday morning W. A. Howell, Chairman of the Sub-committee on Street Paving, presented the report of that committee reviewing the progress of paving matters during the past year. While the outlook for paving had been good early in the year, by June 1st rising prices had made it dubious, causing postponements of many projected works, especially those for the laying of granite block pavements, the cost of the blocks being held too high to warrant general use. In spite of this, the record for the first eight months of 1922 indicates an amount of paving work 50 per cent. in excess for that for the same period of 1921 on the basis of amount of money spent.

This was followed by a paper by Clarence D. Pollock entitled, "Value of Present Tests for Granite in Determining the Probable Wear in Pavements." (This paper is published elsewhere in this issue.) In discussing this paper, Mr. Norton expressed his doubt of the value of a high coefficient of wear in a stone block pavement, believing that some wear is desirable in order to secure and retain a smooth surface, while the increasing scarcity of horse-drawn traffic is rapidly eliminating the necessity for toughness or hardness in paving block material. Mr. Pollock, however, replied that he had found, where bituminous mastic is used as filler and squeegeed over the pavement, that it adhered to the low points for seven or eight years, and that even hard granite wears down on the high points under rubber tires even more than it did under steel tires because of the abrasion caused by the driving wheels of motor-driven traffic. Mr. Durham expressed the opinion that inspection and good laying were more important than testing. Mr. Sprague stated that with automobile traffic the objection to smooth pavements on steep grades had largely disappeared, but Mr. Norton maintained that they still presented a serious danger of skidding, especially when wet leaves were present.

The report of the Sub-Committee on Sidewalks and Street Design was read by E. R. Conant, the Chairman. Mr. Conant presented a very complete discussion of the several elements of sidewalks and streets, and gave a series of general recommendations for the preparing of designs. Considerable discussion followed this paper, dealing with several of the many points brought up. Mr. Pollock suggested that in the planting areas provided in the street plan, maintenance should be by the city in order to secure and



maintain a good appearance. Mr. Folwell stated that a number of cities were omitting catch basins at storm water inlets, and that they should, in his opinion, be considered as special construction, rather than uniform practice, the majority of basins in large cities never being cleaned and, therefore, being worse than useless. One member stated that they were being omitted in warm climates because of the danger of mosquitoes breeding in them, and Mr. Durham stated that in Panama, where the elimination of mosquito-breeding was such an important matter, no catch basins had been allowed or in use for fifteen years, although the sewers were on the combined system, and that no nuisance had resulted. Mr. Rankin stated that the city of Newark, N. J., was considering the elimination of catch basins, while another member stated that in St. Louis, where inlets had been built without catch basins, such basins were being constructed for about 5 per cent. of them.

Concerning the matter of corner radii, Mr. Conant, in reply to a question, referred to an instance of curb corners which were given a 30-foot radius, but this radius compounded into sharp curves at each end, the flat radius thus approximately paralleling the travel of a truck with long wheel-base which, as was the general practice, swung out into the center of the street before turning the corner, and one or two members commented favorably upon this idea. Mr. Corson stated that Norristown found 15-foot corner radii satisfactory. Mr. Laurgaard, city engineer of Portland, Ore., stated that in some of the outlying sections streets twenty to twenty-four feet wide were being built with concave pavements, the inlets being in the center of the street. Commenting on this, Mr. Rankin stated that in Newark, where, as in most cities, the alleys are made concave, manhole covers in the alleys are used as inlets for storm water. In the matter of alleys, Mr. Brown stated that nothing smaller than a 16-foot alley was of any practical use, since, if narrower than this, it was very difficult for a vehicle to enter or leave it from an intersecting street, while with less width the passing of vehicles in the alley was impossible.

"The Crowns of Streets and Highways" was the subject of a paper by G. A. Crayton, State Highway Engineer of South Dakota, which was read by the Secretary. In this paper Mr. Crayton discussed the theoretical cross-section which would secure a uniform velocity of flow of rain water in reaching the gutter, which would result in two concave surfaces intersecting at the center of the street. This would be impracticable, but he suggested a compromise between this and the ordinary convex surface, or two planes intersecting at the center.

George H. Norton, Chairman of the Sub-Committee on Street Maintenance, in presenting the report of that committee stated that it had nothing new to report, but urged a further discussion on the subject of relation between original construction and maintenance, and, especially, a discussion of the paper presented by Mr. Norton at

last year's convention under the title "The Economical Extent of Pavement Repairs and Maintenance."

The Chairman of the Sub-Committee on Street Railway Construction, Henry Maetzel, has been ill for some time and was not present, but reported progress through the Secretary. Papers on "Bituminous Surfaced Gravel for Light Traffic Streets," by D. B. Davis, and "Building Gravel Roads with Bituminous Surfaces," by Philip P. Sharples, had been printed in the advance papers and were read by title and no discussion offered.

As there was some time remaining before adjournment was necessary, the President asked if there were any questions the members would like to discuss, and the "Backfilling of Trenches" was suggested. Mr. Norton stated that in Buffalo clay trenches were replaced by thorough ramming of the clay, when damp but not wet, or else replacing with cinders. The latter was almost as cheap as thorough compacting of the clay. Mr. Pollock referred to the mixing of cement with the dirt in the top foot or two of the backfilling. Mr. Corson reported the practice of replacing pavement foundations over trenches by arching the concrete. Mr. Norton expressed the belief that placing a concrete arch over a trench was not to be recommended, since if the trench settled, the arch was sure to settle sooner or later, and sooner was preferable as it then allowed the placing of the responsibility upon the proper parties. E. R. Gray said that in Hamilton, Canada, the property owner is given twenty days after notice to put in house connections, including those for vacant lots. The result of all connections in the street being put in at once is a very badly cut-up condition. In paving over these trenches, wire mesh was used in the concrete, preceded by a thorough tamping of the trench. He advocated allowing the trenches to settle one year before paving. Mr. Norton stated that in Buffalo property owners arranged with the street paving contractor for putting in any house connections needed, before the pavement is laid, and the paving contractor is then held responsible for the pavement, whatever happens. The work was generally done by plumbers under sub-contract with the contractor, who held these plumbers responsible for any subsequent settlement of the pavement. E. R. Kinsey, of St. Louis, expressed the opinion that a growing city must always expect to have cuts made in its pavement. Mr. Dillon referred to Hamburg, Germany, where, in the case of wide streets, all conduits for local use are placed in the sidewalk area. Mr. Dutton said that in Minneapolis it is impossible to get the soil back so it will not settle. The city ordinance prohibits any cutting of the pavement for two years after it is built, but so many exceptions are obtained, some of them by political pull, that the rule is not generally observed. Mr. Norton suggested a charge of \$25 to \$50 for permit to cut the pavement during the first year after construction, and a reduction in the charge for each succeeding year, believing that there was a legally defensible

warrant for this in the greater loss to the community in cutting a new pavement than in cutting an old one. A member reported that Essex County, New Jersey, had tried bonding those cutting through pavements, but had found it not effective, and now required a cash deposit varying from \$10 for macadam to \$50 for bituminous pavements, the balance to be returned to the depositor after the final repaving; the trench being surfaced on top with bituminous material to carry the traffic for six months, when it was removed and the final surface then constructed.

Very interesting moving pictures were then shown by the International Steel Tie Company, showing the laying of their ties in street railway construction work, and by the White Company, showing the use of their trucks and other vehicles in municipal work.

Wednesday afternoon was devoted to reports of committees on specifications. The report of the Committee on Specifications for Sheet Asphalt Pavements was presented by E. A. Kingsley, chairman. Only a few minor changes were recommended, which had already been printed in the advance papers, the only comment being upon the provision for fineness of sand. The changes were accepted by the convention to be submitted to letter ballot. However, this and another provision were found to conflict with the specifications reported by the committee on Bituminous Concrete, and later, on motion of Mr. Tillson, these two sets of specifications were referred back to their committees for a harmonizing of these differences.

The chairman of the Committee on Specifications for Bituminous Macadam, Bituminous Concrete, and Asphalt Block Pavements, Thomas E. Collins, reported no changes in the specifications for bituminous macadam and asphalt block and only a few minor changes in those for bituminous concrete, which, as just stated, were referred back for harmonizing with those of the committee on sheet asphalt. It is probable that the work of both of these committees will be combined in one committee during the coming year as a result of the constitutional amendment adopted relative to committees.

The report of the Committee on Specifications for Broken Stone and Gravel Roads, D. B. Davis chairman, was presented by Cameron Corson, a member of the committee. Several changes were recommended and the entire specifications were redrafted. The new draft had been published in the advance papers and was accepted for reference to letter ballot.

The chairman of the Committee on Specifications for Brick Pavements, George F. Fisk, recommended no changes but desired to submit questionnaires on two points to the society's membership as a basis of recommendations to be submitted next year.

The report of the Committee on Specifications for Cement Concrete Pavements, Thomas J. Wasser chairman, was read, but as it had not been received in time for publication in the advance papers, could not under the Constitution

be accepted at this convention and was referred back to be re-submitted next year. A few minor changes were recommended, chiefly in the sand and slump tests.

No report was submitted by the Committee on Specifications for Stone Block Pavements. The Committee on Specifications for Wood Block Pavements, E. R. Dutton chairman, had no changes to recommend at this time. Mr. Dutton reported that he is trying out a pavement of wood blocks two inches deep and will report on the result of this test.

The Committee on Specifications for Sidewalks and Curbs, H. A. Rowland chairman, had no changes to recommend.

The Committee on Specifications for Sewers, C. L. Howell chairman, reported that unanimous agreement by the committee had not been secured on certain points, and he recommended that the report be referred back to be reported to the next convention.

The report of the Committee on Specifications for Subgrades and Foundations, Frederick A. Reimer chairman, was accepted for submission to letter ballot, except that the matter of black base was referred back for action next year.

Specifications for street railway pavement, including track construction, had been presented by the committee last year and referred back to it at that time to permit a discussion with a similar committee of the American Electric Railway Association. The chairman, Charles E. De Leuw, reported that his committee had not been able to obtain a conference with the committee of the railway association, but that association was meeting in Chicago the same week that the A. S. M. I. was convening and that he hoped to obtain a conference during that convention and be able to report to the society next year.

T. P. Smith, chairman of the Special Committee on Standard Tests for Bituminous Materials, presented a complete report recommending tests, chiefly based upon those of the Society for Testing Materials, which report was accepted.

The report of the Special Committee on Standard Tests for Non-bituminous Paving Materials, Prof. A. H. Blanchard chairman, was postponed and was submitted on Friday morning.

(To be continued)

### Fuel Oil in Harbors

In an address on this subject before the American Society of Port Authorities on September 14th, Bancroft Hill, president of the Harbor Board of Baltimore, emphasized the importance and difficulty of keeping waste oil out of our harbor waters. It causes fires and destroys fish, oysters and ducks; but the oil-burning boats must dispose of it in some way, and it is up to the harbor authorities to provide a way that is legal and harmless. This would seem to require that the authorities collect the waste oil from the ships and themselves dispose of it. Burning seems to be the only practicable disposition, for so far no method has been discovered for making use of it.



# N. E. W. W. Convention

Papers and discussions at the September convention of the New England Water Works Association

The Annual Convention of the New England Water Works' Association was held at New Bedford, Mass., on Sept. 12th to 15th. It was a successful convention, the program well-balanced between technical discussions, inspection of engineering works, and entertainment and social features. The only untoward event was a rainstorm which drenched a number of those who were inspecting the water works properties of the City on the first day of the Convention.

The total attendance registered with the Secretary was about 450, of which about 160 were active members. The meetings were well-attended, ordinarily about 100 to 125 being present shortly after the opening of each session. The Program Committee had left abundant time for discussion of the papers, so that it was not necessary to cut short the discussions at any point. As much discussion did not materialize as there was time for and as might have been profitable, and most of the sessions adjourned because of the conclusion of the program and discussions rather than from pressure of time.

The exhibition was located adjacent to the Convention Hall, and was very attractive, there being about 45 exhibitors.

The program Tuesday opened with the address of welcome by Mayor W. H. B. Remington, following which was the description of the New Bedford Water Works by the Superintendent, Stephen H. Taylor, who also described some experiments with substitutes for lead in jointing cast iron pipe; these being preliminary to the automobile ride in the afternoon to the Quittacus pumping station, the reservoir and other parts of the system, and an exhibition of the laying of iron pipe with leadite. The speed of laying this pipe was favorably commented on by the superintendents, who were assured that it was no greater than ordinary every day practice with the Water Department, except that, possibly, a greater length of trench than ordinary was open; trench excavation being, in fact, the only limitation so far encountered to the speed in pipe laying. The evening of Tuesday was the occasion of an informal reception and dance at the Hotel.

#### WEDNESDAY'S SESSIONS

Wednesday morning opened with a paper by David A. Heffernan, superintendent of the water works of Milton, Mass., who discussed the relation between quality of water and the duration of service pipes. He stated that investigation in his City had, apparently, proved that galvanic action was caused by current from the grounding of house wiring by attachment to the water pipes, the action entirely ceasing when the wires were removed. A method of prevent-

ing this adopted in Milton was to attach the ground wire between the cellar wall and the meter and insert an insulation in the pipe on the house side of the point of attaching the wire. In the discussion several members raised a question as to the possibility of galvanic action resulting from the grounding of wires of a system carrying only alternating current, Mr. Kemble stating that experts have advised making such connections, and that this advice was also given by a committee of the American Water Works' Association appointed to report on the subject; but Mr. Heffernan stated that investigation by experts in his city had proved the facts as stated by him.

Later in the discussion, Mr. Heffernan stated that he did not think check valves should be allowed on service pipes in connection with pressure boilers, as they might be the cause of explosions, and in this opinion he was supported by other members. In connection with damages for collapsed boilers due to any responsibility of the Water Works Department therefor, Secretary Gifford stated that Boston pays for collapsed boilers, following a decision of the Superior Court that the city was responsible. At the conclusion of the discussion it was voted that the President appoint a Committee to study the general subject of "Currents in House Plumbing."

The subject of the removal of gas and odors and prevention of corrosion having been raised by Mr. Heffernan, George W. Fuller was asked to give some information on the subject, and stated that the former could generally be effected by the use of filtration and aeration, and that corrosive properties of the water also were largely removed by aeration. In Memphis the Water Department is confronted with the problem of rendering suitable a water carrying from 85 to 120 parts of  $\text{CO}_2$ , and the treatment that will probably be used is aeration and the addition of lime.

The next paper was one entitled, "Co-operation," by Francis T. Kemble, secretary of the New Rochelle Water Company. The principal point made by Mr. Kemble was the importance of getting the employees to put their heart into the work they did for the water department or company, this being worth more in results obtained than either ability, or experience. He stated that he keeps his gang all winter, finding work of some kind or other for them to do. Mr. Saville also stated that he keeps a large gang through the winter on forestry and other work. Another member, however, stated that he found it impossible to keep more than a small part of his men through the winter, and believed that it was necessary to adopt labor-saving machin-



ery to solve the labor problem. Mr. Little reported finding it difficult to get energetic men for digging, but Mr. Saville said that he does not try to obtain young men for this, as they are difficult to keep, but uses the old men who have been with the department for many years and are experienced and reliable. He suggested a system of pensions as desirable to encourage the men to remain with the department, and Mr. Gear cited the state law for pensions in Massachusetts, which retires laborers at half pay at 65 years. Mr. Taylor stated that he found Portuguese labor to be better than Italian.

Thos. E. Lally, assistant engineer with the Public Works Department of Boston, read a paper on the "Inspection of Water Works Equipment." He described a number of the details of inspection, as well as its advantages and necessity; for instance, he stated that Boston has long used wicking boiled in tallow as packing for the stuffing boxes of valves.

In the afternoon Percy R. Sanders read a paper entitled, "Pumping by Electricity at Concord, New Hampshire." This paper will be published in "PUBLIC WORKS." By the change from steam to electricity the city saves entirely the salary of a fireman. The same engineer still operates the plant. During the two-and-a-half years that the pump has been in service there has been no shutdown from electric trouble. Mr. Diven and others told of experiences with centrifugal and volute pumps, one of the latter types operated by the Public Service of New Jersey having shown an efficiency of 80%.

"Experiences with a Thirty-Five-Year-Old Steam Pump" were narrated by Fred O. Stevens, this pump being a duplex, compound steam pump of 1½ million gallons' capacity which had operated twenty-nine years at full overload and six years at normal load. In 1920 one of the cylinders cracked and was repaired and an electric centrifugal was installed as quickly as possible because it could be obtained sooner than a steam pump. Later, cracks developed in both suction chambers, and these were repaired with hot asphalt applied on the outside, the pump being turned over slowly meantime so as to draw the asphalt into the crack. This served the purpose quite successfully until the plant had been reinforced so as to permit the permanent repair of the pump.

George A. King, superintendent of the Taunton Water Works, started a discussion as to whether the water department should be merged with other municipal departments in its management and finances. The members seemed to be more or less divided on the subject, although the majority of the superintendents present appeared to be strongly in favor of absolute independence for the Water Department. Mr. Sherman expressed the opinion that while, in a large city, a good man could be provided for each department and thus independence with efficiency was practicable, in the small city if several departments were merged, as into a department of public works, there would be one man in charge of several departments who might be an expert in one line only, which line

would probably not be water, and he therefore thought that independence was especially important for small cities. M. N. Baker, however, believed that, because it was difficult for a small city to employ an expert for each of the departments, the efficiency of the water department, as well as of the other departments, would probably be greater with the departments merged and placed under the head of an efficient man, rather than having a low-salaried man for each department. Messrs. Simonds, Thomas, Diven, Gifford and others joined in the discussion, at the conclusion of which it was voted that three Massachusetts members be appointed to take up with the Massachusetts Legislature the subject of merging the water department with other departments in management and finances, this subject being one which the Legislature was expected to consider before long.

There still remaining considerable time before adjournment time and this being Superintendents' Day, the meeting was opened for questions. One member asked whether any cities had high and low service systems with an electrically operated gate between them, and two or three members told of services connected in somewhat this manner, although not quite the same. Another member introduced the question as to who should be allowed to operate fire hydrants. Two or three members stated that in their cities the Moth Department was the largest user of water, and there seemed to be an opinion that that department should be permitted to use the fire hydrants without special permits for each occasion.

In the evening Caleb M. Saville discussed the subject of "Cross Connections for Private Fire Protection." From experiences Mr. Saville had reached the conclusion that even a double check did not offer perfect security, and in this he was supported by a number of members. Mr. Winslow told of an instance where both checks were held open by a pair of overalls a little longer than the distance between the valves. The double check was defended by a representative of the fire insurance companies in a prepared discussion. One of the members stated that the Factory Mutual was practically alone in strongly advocating the double check. Mr. Diven advocated two entirely unconnected supplies where the factory thought it necessary to have its private supply for fire purposes.

#### THURSDAY'S SESSIONS

On Thursday morning, after electing seven new members (thirteen had been admitted on Wednesday morning), the Joint Committee on Meter Specifications, which co-operated with a similar committee of the American Water Works' Association, stated that the joint report had now been brought to the point where it could be put in formal shape for consideration at the winter meeting of each of these societies.

F. X. Goodnough, chief engineer of the Massachusetts Department of Health, described "The Water Supplies of Southeastern Massachusetts." As Fall River and New Bedford together contain more than 80% of the population

of this section of the State, the discussion was confined largely to the consideration of the water supply of those cities. Fall River is now using all the water available from North Pond, while South Pond is smaller and the water is grossly polluted and, in addition, is needed for the mechanical purposes of the mills of the city. There seemed no question but that the city must ultimately go to the Lakeville Ponds, several miles to the northeast. New Bedford, by metering, had kept the consumption down to 83 gallons per capita, but is now using 80% of the safe yield, and, if its growth continues, will also need before long to obtain water from the Lakeville Ponds. Taunton, the next largest city in the district, obtains its supply from these ponds, but does not need the full amount that it controls. The time was rapidly approaching, therefore, when these cities, with the State Board possibly serving as advisor and arbitrator, would have to come to some agreement on the use of the water from these ponds.

Following the reading of this paper by Mr. Goodnough, he was notified by Mr. Weston, for the Committee on the Award of the Bracket Medal, that the Medal for last year had been awarded to him.

H. K. Barrows, of Boston, then described the water supply of Fall River, bringing up to date a description of the same supply which he had presented to the society several years ago, and supplementing the brief description of the supply given in Mr. Goodnough's paper. In view of the fact that Fall River, New Bedford and Taunton were not in accord in the matter of the Lakeville Ponds, each, naturally, viewing the matter from its own standpoint and desiring to control as much as possible of this water, some of the members had expected the discussion of these two papers to be quite peppery, but, as a matter of fact, nothing but technical principles and good nature prevailed.

The last paper of the evening was a description of the "New Water Supply of Providence" by Frank E. Winsor, chief engineer of the Water Supply Board. The construction details of the new water supply were described in last month's issue of "PUBLIC WORKS."

The afternoon session opened with a renewal of the discussion on the double check valve. During the discussion Mr. Saville expressed his opinion that the only advantage of the double check is its cheapness. In Hartford it is permitted to discharge the city supply into a tank, the outlet of the supply pipe to be above the level of the tank, which tank should then connect with the factory's private supply. This method was believed to be safe, but would cost a little more than a double check.

"A New Method of Purifying Water" was then described by Harry W. Clark, chief chemist of the Massachusetts Department of Health, the method consisting of the use of slow sand filters treated with aluminum hydroxide. This paper will be published in "PUBLIC WORKS." This method was said to cut the cost of precipitant from the five to six dollars per million gallons

required for rapid sand filters to fifty-five cents per million gallons, or less. In answer to a question, Mr. Clark stated that the hydrogen-ion value was increased by this treatment. He also stated that hydroxide precipitated slowly as the water containing the solution was held in the filter and the precipitate coated the individual sand grains.

Thursday afternoon those attending the Convention were taken by steamer around Buzzard's Bay and by trolley to Fort Phoenix, where a clambake was served.

#### FRIDAY'S SESSIONS

Friday morning was devoted to papers on use of water for fire protection, Frank A. McInnes, engineer of the Water Division of Boston, describing the Boston high pressure service; George W. Booth, chief engineer of the Board of Fire Underwriters of New York, discussing "High Pressure Fire Systems from the Underwriters' Viewpoint"; which papers were followed by statements from fire chiefs on the "Value of High Pressure Service from the Fire-Fighters' Viewpoint." Mr. Booth, using as an illustration some of the big fires in New York City, showed that with high pressure, fewer companies would be required for fires that called for large quantities of water. In one fire in New York this year more than 30,000 gallons per minute were being discharged at a pressure of over 200 lbs. at the hydrant, which would have required the service of sixty fire companies if fire engines had been used. Mr. McInnes stated that the Boston High Pressure System, as proposed, will protect about one square mile, which includes practically the entire congested value district. There will be eight pumping units in three separate stations. Two of these stations feeding 313 hydrants have been in service for eight months. For joining the pipes in the distribution system an alloy of 95% lead and 5% tin is used, and two lead grooves are cast in the bell end and spigot end of each pipe. Tests showed that the addition of the tin made the joints sufficiently strong to permit dispensing with tie rods. The tin is added to the hot lead at the last minute just before pouring. Calking is done with dog tools, using a two-handed 4-lb. hammer, and is finished or polished off with hand tools.

In the afternoon E. Sherman Chase read a paper entitled, "Sanitary Dangers to Water Supplies"; J. E. Garratt, office engineer of the Hartford Water Board, described the "Application of Copper Sulphate to the Hartford Reservoirs and Some Effects on Length of Filter Runs," and Robert Spurr Weston gave an "Elementary Discussion of the Hydrogen-ion Determination and Its Significance." Mr. Garratt's paper was a description of the experiences of Hartford, and some questions concerning the details of the use of copper sulphate raised by these experiences. One tentative conclusion reached was that the application of copper sulphate has possibilities as an aid to economical filter operation, at least with Hartford's water.



# Rental of Contractor's Equipment

**Form of agreement adopted by Associated General Contractors for use in renting such equipment. Conditions of lease set forth plainly and fully.**

The Executive Board of the Associated General Contractors has adopted an equipment rental agreement as a standard for use by contractors, which has been developed after two years' study and criticism by association members. It is based upon the premise that a contractor will be willing under this form to assume the obligation of either the lessee or lessor. Its object is to establish on a basis of common equity those obligations and responsibilities properly involved in renting construction machines and to provide a simplified rental agreement which will insure absolute fairness to both parties.

Misunderstanding has frequently arisen in the past when equipment was rented by either verbal or written agreements or by an unsuitable form of lease. It was thought that the misunderstandings and inequities resulting from such conditions could be avoided in most cases if there was a standard form of lease which could be filled out easily or accepted by wire or otherwise for later official signing.

The standard form is arranged so that all blank spaces for filling in of dates, rental rates and other stipulations are segregated on the front of a single sheet, while those provisions of general application and requiring no filling in for ordinary conditions are segregated on the back. Copies of the form can be obtained from the Associated General Contractors of America.

The front page of the lease provides for filling in the date, the names of the parties, the point at which the equipment is furnished f. o. b., a description of the equipment, the place at which it is to be used, the approximate rental period, manufacturer's shop number, the lessor's identification number, the value of the equipment, and the rental rate per article. This is followed by the signatures of lessee and lessor and two witnesses. The general conditions of the lease are as follows:

The conditions of lease here below stated, together with the Agreement set forth on the reverse side of this sheet, constitute between the parties therein named a contract which is hereafter referred to as this Agreement.

**1. The Rental Period.** The Rental Period shall begin on and include the date of either legal delivery of the equipment to the Lessee or his agent, or legal delivery to a public carrier for transit to the Lessee; and shall end on and include the date of either legal delivery of the equipment to the Lessor, another lessee or an agent of either, or legal delivery to a public carrier for transit to the Lessor or another lessee.

**2. Determination of Rental Charges.** The Lessee shall pay rental for the entire Rental Period on each

article of equipment named in the List of Equipment, at the rate therein stipulated and in accordance with the following:

**(a) Monthly Rental Rates** shall not be subject to any deductions on account of any non-working time in the month, but the amount of rent payable for any fraction of a month at the beginning or end of the Rental Period shall be the monthly rental rate, prorated according to the number of calendar days in such fraction.

**(b) Daily Rental Rates** shall not be subject to deductions for any non-working time in the day and shall be paid for each calendar day in the month except Sundays and legal holidays upon which the equipment is not operated.

Daily and monthly rental rates stipulated in the List of Equipment contemplate an operating day of ten (10) hours, and for each hour over ten that the equipment is regularly operated these rates shall be increased four (4) per cent throughout such period as the equipment is so operated.

**(c) Unit of Work Rates** shall be paid for each unit of work in which the equipment participates, and the amount of rental shall, unless otherwise agreed in writing, be determined by the number of units shown in the supervising engineer's or architect's estimates.

**3. Payment.** The Lessee shall pay to the Lessor as the minimum amount due under this Agreement, two (2) per cent of the value as shown under List of Equipment of each article of equipment, and shall pay as the minimum rental on each such article, loaded for transit to the Lessee, four (4) per cent of such value.

The amount of rental accruing each month shall be paid on or before the fifteenth of the following month at the office of the Lessor or such other place as may be mutually agreed upon.

Deferred payments shall bear interest at seven (7) per cent, but the payment of this interest shall not waive the Lessor's right as hereinafter stipulated to terminate this Agreement.

**4. Loading, Unloading and Transportation.** The Lessor, at his own expense, shall load the equipment for transit to the Lessee and upon its return unload it, and shall pay all demurrage charges accruing at his own shipping or receiving point. The Lessee, at his own expense, shall do all other loading, unloading, installing, dismantling, and hauling, and shall pay all demurrage accruing at his own shipping or receiving point, and all freight and switching charges.

The Lessor may ship the equipment in accordance with his own judgment if shipping instructions are not furnished within seven (7) days from date of this Agreement.

**5. Recalling and Returning Equipment.** The Lessor may recall any or all equipment upon thirty (30) days' written notice to the Lessee and the Lessee may return any or all equipment upon a like notice to the Lessor.

**6. Maintenance and Operation.** The Lessee shall not remove, alter, disfigure or cover up any numbering, lettering or insignia displayed upon the equipment, and shall see that the equipment is not subjected to careless or needlessly rough usage; and he shall at his own expense maintain the equipment and its appurtenances in good repair and operative condition, and in such condition return it to the Lessor.

**7. Supplying Operators.** Unless otherwise mutually agreed in writing the Lessee shall supply and pay all operators employed on the equipment during the Rental Period, and shall employ none thereon who are incompetent to perform their respective duties. Should the Lessor, by agreement, furnish any operators, each shall receive from the Lessee such traveling expenses, board, lodging, and wages as the Lessee and the Lessor may agree upon in writing.

**8. Damage to Equipment.** The Lessee shall indemnify the Lessor against all loss and damage to equipment during the Rental Period and the appraisal of any such loss or damage shall be based on the equipment values shown by the List of Equipment. Any shortage or damage claim of either party shall be made known to the other party within seven (7) days after receipt of equipment, or such claim shall be void.

**9. Repairs.** The Lessees shall pay the cost of re-



rolling old boiler tubes and of all other repairs and renewals, except that if, in any calendar month, more than seven (7) per cent of the total number of such tubes should, under reasonable care, require replacement, the direct labor and material cost thereof over and above that of the seven per cent shall be borne by the Lessor.

**10. Liability of Lessee.** The Lessee shall indemnify the Lessor against all loss, damage, expense and penalty arising from any action on account of personal injury or damage to property occasioned by the operation, handling or transportation of any equipment during the Rental Period.

**11. Inspection.** Before the equipment is loaded for transit to the Lessee, he may require an inspection thereof by proper authorities, and if the equipment is not in substantially the condition required by this Agreement the cost of inspection shall be paid by the Lessor.

The Lessor shall have the right at any time to enter the premises occupied by the equipment and shall be given free access thereto and afforded necessary facilities for the purpose of inspection.

**12. Title.** Title to the equipment shall at all times vest in the Lessor unless transferred to the Lessee through sale. The Lessee shall give the Lessor immediate notice in case any equipment is levied upon or from any cause becomes liable to seizure.

**13. Termination of Agreement.** Should the Lessee defer any payment more than thirty (30) days, or become bankrupt, or fail to maintain and operate or to return the equipment as provided by this Agreement, or substantially violate any provision thereof, the Lessor may, after three days' notice, terminate this Agreement, take possession of the equipment without becoming liable for trespass, and recover all rental due, full damages for any injury to, and all expense incurred in returning the equipment.

Should the Lessor fail to ship the equipment in substantially the condition stipulated by this Agreement, or within ten (10) days from date thereof, or substantially violate any provision thereof, the Lessee may, upon three (3) days' notice, terminate this Agreement, recover all sums paid the Lessor, and in case of shipment not in operative condition as specified may return the equipment at the Lessor's expense.

**14. Insurance.** The Lessee shall, at his own expense, maintain fire and other insurance, if requested by the Lessor.

**15. Bond.** The Lessee shall, if requested by the Lessor, furnish a bond in amount of the value of the equipment as shown by the List of Equipment, and with the sureties satisfactory to the Lessor, to insure fulfillment of this Agreement.

**16. Sub-Letting.** No equipment shall be sub-let by the Lessee, nor shall he assign or transfer any interests in this Agreement without written consent of the Lessor.

**17. Purchase of Equipment.** Should the total continuous rental paid by the Lessee for any units of equipment amount to one hundred and fifty per cent (150%) of the value thereof as shown by the List of Equipment, no further rental shall be paid on such units and the title thereof shall vest in the Lessee, and he shall have the right at any time upon thirty (30) days' notice to purchase any equipment by paying the difference between the total continuous rental already paid and one hundred and fifty per cent (150%) of the value—payment of such difference to be made upon such terms as the two parties may decide.

### Fair Allowance for Force Account Work

The "Members' News Letter" of the Associated General Contractors discusses editorially the question of what is a fair percentage allowance over net costs to provide for incidentals in connection with force account work where the cost of labor and insurance only is allowed. In a contract between a member of the Association and the chief engineer of a Flood Control Board

it is provided that the contractor realize a 15% profit, and the determination of the allowance necessary to insure this has been left to the Associated General Contractors for decision.

The contract is for the construction of a dam in which, owing to indefinite foundation formations, the work involves considerable force account work which is to be paid for by the Flood Control Board, including all necessary expense connected with it.

It has been common practice to allow a contractor a carrying charge to cover the cost of maintenance of men, including such details as loss on boarding houses, cots, mattresses, tent depreciation, water supplies, transportation, etc. The work is located 25 miles from town on the desert where the water supply is very costly.

The preliminary opinion of the A. G. C. is based on the assumption that the work being done on the main contract is small in comparison with the force account work on the foundation, and that under these conditions the fair and usual procedure would be to divide the field overhead expense in relation to volume of contract work and of force account work as indicated by the payroll. If the payroll was running \$3,000 a week and \$1,000 was indirect expense and the balance was proportioned equally between contract and force account work, the fair and equitable distribution then would be 50% of the overhead on the force account work and 50% for contract work.

It is assumed that the camp outfit would last only the life of the job, assumed to be one year, and that for the plant 4% per month of original cost should be charged for use and depreciation. From the incomplete information at hand it was concluded that the actual cost of overhead and indirect expenses would be from 15% to 20% of the direct labor and material costs.

### Testing Bridge Foundations

Engineers of the State Highway Commission of North Carolina have profited by experience in the past in their own state and in others where too little attention has been paid to the foundation of bridges and many otherwise substantial structures have been destroyed because of this. In the July issue of the North Carolina Highway Bulletin, the monthly publication of the State Highway Commission, P. K. Schuyler describes the method now employed by the Commission through its Bridge Department in determining the character of foundations upon which its bridges are to be built.

There are five general methods employed—the open pit method, the use of sounding rod, of an earth auger, by wash borings, and by diamond drill borings.

The open pit method consists of digging a hole in the ground, but the labor and expense involved is considerable if carried to any appreciable depth. The sounding rod method is fairly satisfactory for a depth of 15 to 20 feet, but it is almost impossible to determine by its use whether it has struck a layer of rock or hard

gravel. The earth auger is very satisfactory and economical up to a depth of 20 feet under certain conditions. Samples of the material encountered may be brought up for examination and solid rock may be determined by the clear ring which is given off when the auger is dropped. The earth auger and the wash boring methods are perhaps the most satisfactory and generally used. The diamond drill is expensive and its use is seldom justified except for structures of unusual size or where there are unusual foundation conditions.

The wash boring method is comparatively inexpensive and when used in connection with the earth auger it covers practically every condition. Where the earth auger will not penetrate deep enough, or where the borings must be made in the bed of the stream, the wash boring method is desirable. In the examination of bridge sites throughout North Carolina the Bridge Department has used with success a wash boring outfit described by Mr. Schuyler as follows:

"It consists of a 2 inch casing pipe which is driven into the ground by a 120-pound hammer pulled up by a hand in a set of 16 foot leads and allowed to drop. Inside of this casing pipe is a wash pipe  $\frac{3}{4}$  of an inch in diameter through which water is forced under 30 pounds pressure by a 2 h. p. gasoline engine. The material is washed up between this pipe and the casing and is caught in a bucket or some vessel for examination. The outfit is transported from place to place in a G. M. C. light aviation truck rigged up especially for this purpose.

"Practically all of the material used in the construction of the outfit was obtained from surplus war material allotted to the state by the Federal Government, thus making the construction cost practically nothing. The truck in which it is transported was also allotted to the state from surplus war supplies. The total cost of operation, including all overhead expenses, runs about 75 cts per lineal foot of boring up to 50 feet, which is the greatest depth that the machine is capable of boring. The force required to run the outfit consists of an engineer in charge, truck driver who also operates the pumping engine, and two laborers who are obtained locally. One boring requires about one day, much of the time being consumed in unloading and making the set up.

"The saving to the state by the use of this

outfit has been considerable, since the results obtained often bring about a change in the contemplated design and further enable the contractor bidding on the work to know what conditions he will encounter, thereby making it possible for him to submit a lower initial bid."

## Pipe Laying by Compressed Air

Use of an air drill to drive a pipe underground. Three-inch pipe driven through embankment.

The Commonwealth Edison Company has used a rotary air drill in a manner which suggests that the same device might be used for laying water and gas mains with equal success. In this instance the company desired to carry its wires under a railroad embankment 18 feet high and 75 feet wide, rather than use high poles for an overhead crossing. Instead of laying the conduits in open trench, it drove two 3-inch iron pipes through the embankment and carried the wires through them.

In driving the pipes through the earth, an air drill was used to rotate them and at the same time force them forward. The lengths of 3-inch wrought iron pipe were united with extra heavy couplings which had an outside diameter of 4.1 inches. A cone-shaped pilot was constructed, the cone being 3 feet long and 4.5 inches in diameter at the base, terminating in a cylinder 3 inches long. The cone was hollow and served partly as a reservoir for the lubricant, which was allowed to ooze out through six holes in the side of the shell, the escape of the lubricant being aided by a spring which forced a piston against the lubricant. On the outside of the cone were six flanges arranged in pairs and with a pitch such that, as the pilot was rotated from left to right, the flanges would draw it forward into the earth.

The flanges were effective for about 30 feet, but beyond this the friction was so great that positive feeding was necessary. A sleeve with a threaded interior was fastened to two anchors so that its axis coincided with the axis of the pipe. A hollow jack-screw 6.5 feet long was passed over the pipe and through this sleeve. In front of the jack-screw and fastened to it was a split pipe clamp. The jack-screw was then turned by the air drill, forcing the pipe forward. When it had progressed in this way 6 feet, the clamp was loosened, the air drill reversed and the clamp pulled back 6 feet, and again tightened on the pipe and forced forward. When the end of one length of pipe had been reached, a short piece was used as a spacer until the first pipe was far enough forward to permit inserting another standard length, when such length was substituted for the spacer. When the pilot had been



PILOT WITH FLANGES FOR DRIVING 3-INCH PIPE THROUGH EMBANKMENT.



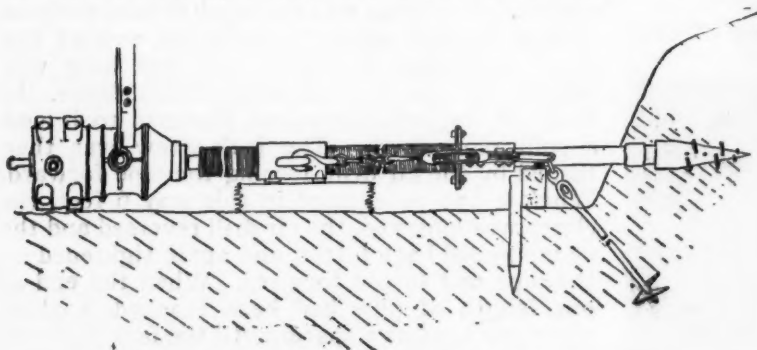


DRILL CONNECTED TO PIPE; WILMETTE PIPE  
FORCING JOB.

Driving gas service under boulevard pavement.

forced forward 45 feet it turned with great difficulty, which it was learned was caused by the fact that it had struck slag ballast that had been used under the track before it had been elevated. Through this ballast it required 8 hours to move forward 12 feet. From this on it rotated more easily and in another 6 hours the remaining 18 feet of pipe had been pushed forward and the pilot had reached the further side of the railroad right of way. An excavation was then made down to the pilot, which was found to be only 4 inches off the desired line. A second pipe was then installed in the same way, the pilot being 18 inches out of line when it reached the further end. The total time consumed in forcing the two lines of pipe was eight days. Probably by taking advantage of the experience gained the same work could be done again in half that time.

The total cost of the equipment and the wages of the crew for eight days was \$335. This does not include the cost of pipe. What the cost would have been to have excavated through the embankment and laid the pipe it is difficult to estimate. The embankment contained a number of large rocks and, because of the continual passage of trains during the day time, it would have been necessary to work at night, with a railway force on hand to place any timbering under the tracks that might be required. It was



FORCING 3-INCH PIPE THROUGH EMBANKMENT.  
Sleeve anchored to the ground, hollow jack-screw, air drill  
and pilot.

believed that \$500 would have been the minimum cost for this method.

The same pilot was used later for driving two 4-inch pipes and a 3-inch pipe under the street. The method is apparently practicable only for wrought pipes and not for cast iron pipes with their large bells. For a number of years it has been more or less common practice in several cities to drive 1-inch pipes for house connections by simply forcing them forward by means of jacks. The method described herein, however, has been used for 4-inch pipes and could, we presume, be used with even larger ones. It would appear to be too expensive for laying mains in general, but for avoiding tearing up streets which are to be crossed by pipe lines, for passing under embankments or any other locations where excavation would be unusually expensive, the use of this revolving device would seem to be worth consideration.

### Cement Joints for Cast-Iron Pipes

The relative merits of lead substitutes such as leadite, hydrotite, etc., were discussed by the New England Water Works Association last fall and the discussion published in the "Journal" of that association this spring. After reading this discussion, B. D. Clarke, consulting water supply engineer, of Portland, Oregon, recently called attention to the fact that about six years ago, at his recommendation, the city of Portland began using cement for making joints in cast-iron water mains. This was undertaken because the author learned in 1915 of the experience of William Mulholland in using such joints in Los Angeles, and that of James D. Schuyler at an earlier date.

In 1915 or early in 1916, 1,000 feet of 8-inch pipe was laid with cement joints in Portland, "which proved to be so successful that other lines



VIEW OF SLEEVE, JACK-SCREW  
AND DRILL.



speedily followed until at the present time, as I am informed by Chief Engineer F. W. Randlett of the Water Bureau, practically no other calking material than cement is used, except in special cases where the main must be put in to use before the expiration of the 48-hour period necessary for the proper setting of the cement joint."

In making the joints, first quality, medium setting cement is used, mixed so dry that the impress of the hand will be left upon a small ball, which will crumble when let fall from the height of 12 inches. The spigot is supported at the proper position in the bell by placing a small bit of lead under it and just enough yarn is calked into the back of the annular space to keep the cement from entering the pipe. This annular space is then filled with cement which is thoroughly compacted with a yarning iron, and more cement added and compacted, until the face of the joint can be properly smoothed.

Up to the present time the city has laid approximately 7.8 miles of 4-inch to 16-inch pipe with cement joints, and about 4,000 feet of 24-inch to 30-inch pipe laid with lead joints has been taken up and relaid with cement joints in connection with grade crossing elimination. About 500 feet of 30-inch pipe was laid in tunnel, which afforded an opportunity to observe the leakage. It was found that there was considerable leakage at first but at the end of six months it had stopped entirely and all joints have since been tight. At another point 100 feet of 16-inch pipe that had been laid with cement joints was raised approximately 4 feet under the service pressure of about 70 lbs. without any leaks resulting.

### Floating Islands in Storage Reservoir

The storage reservoir of Charleston, South Carolina, has a capacity of 2,781,660,000 gallons. The flooded area which now comprises the reservoir had formerly been the site of numerous rice fields which, after abandonment of the rice growing industry, had grown up with heavy marsh grass. This grass had sent its roots downward two or three feet and spread in all directions until they formed a closely interwoven mattress.

When it was decided to use this area for a reservoir it was thought unnecessary and prohibitively expensive to remove this vegetable growth and the marshy soil, it being believed that the flooding of the land would kill the vegetable matter and that it would be oxidized within a reasonably short time.

As a matter of fact, when the reservoir was flooded the mattress of roots and the marsh soil in which they were imbedded tore away from the soft underlying soil and floated to the surface. These masses of floating matter offered fertile soil for semi-aquatic and land plants, even small willow, cypress and pine trees growing on some of the larger islands. These islands have been drifting back and forth in the reservoir with the winds and currents for a number of years and the water company (which owned the plant until it was purchased about six years ago

by the city) anchored a number of them in shallow places along the shore and removed others which had floated into and blocked the spillway entrance. In some cases willows had sent their roots into the bottom of the reservoir, anchoring the islands, and had grown into quite large trees.

It was feared that islands might float against the spillway, blocking it at a critical time. In fact, it was thought that this was one of the contributory causes of the overtopping and failure of the earth embankment of the reservoir in July, 1916. Another bad feature of these islands was that the rapid growth around them of the semi-aquatic plants threatened to cover the entire water surface and had begun to seriously interfere with the absorption of oxygen from the atmosphere.

The Water Department was authorized to undertake the removal of about 50 acres of these islands during the fall of 1921. No information seemed available as to the best equipment for doing this work, but a plant was constructed by the manager and engineer, J. E. Gibson, consisting essentially of a large rake operated as a drag line by which the material was drawn up onto the bank at the point nearest the island. Two 8-foot by 16-foot lighters were lashed together and on these were mounted a hoisting engine and a simple wooden tower for carrying one end of the drag line cable equipment, the other end of which was anchored on shore. The hoisting engine and cable equipment was hired for \$400 and the rake was manufactured at a cost of about \$245. The lighters cost \$1,018; mounting the engine on them cost \$56, and small boats and other apparatus cost about \$81, or a total for the equipment of \$1,800. The labor cost was \$3,315, with \$1,123 for superintendence and overhead and \$50 for engineering; while fuel cost \$208, supplies other than fuel, \$206, and repairs, \$63. This made the total cost \$6,774. With this sum the department removed 125 acres of grass and marsh, or \$54.20 per acre.

Since the removal of the islands not only is the reservoir more attractive in appearance but there has been a marked increase in the dissolved oxygen in the water and a corresponding decrease in its carbonic acid contents.

### Mosquito Control by Use of Fishes

Investigation of the use of minnows and other small fishes for mosquito control have been undertaken by several investigators whose findings are being made public from time to time. Among the latest is a study by J. Percy Moore, professor of biology in the University of Pennsylvania, described in the report of the U. S. Commissioner of Fisheries for 1922.

Professor Moore carried on his investigations chiefly in the eastern parts of Pennsylvania and New York, although observations were made in other portions of those states and in New Jersey, Delaware and Maryland. (A previous investigation on the same subject made for the Government was confined largely to the southern waters. See PUBLIC WORKS for Oct. 8, 1921).

Professor Moore considered the value of the following fish in keeping down the growth of mosquito larvae: Roach or golden minnow, goldfish, mud minnow, common killifish, translucent killifish, common southern top minnow, blue-spotted sunfish, long-eared sunfish and the common sunfish. He concluded the roach and goldfish have little value as mosquito destroyers. The mud minnow has as its chief drawback the slowness of multiplication, which might be overcome by artificially propagating the fish. The common killifish has thoroughly established its value in limiting the number of salt marsh mosquitoes in New Jersey, New York and Connecticut. The author recommends the translucent killifish in preference to the common killifish for muddy ponds and sluggish streams. The top minnow is excellent for this purpose and increases with great rapidity, but does not occur naturally in the northern districts where these experiments were made and did not survive the winter in ponds in the vicinity of Philadelphia. However, a brood stock could be carried through the winter in a greenhouse or other suitable place for release the following Spring. Both the blue-spotted and the long-eared sunfish have considerable value, but Professor Moore found the common sunfish to be even more valuable, especially the young because they can reach the extreme margins of the ponds, being in fact nearly equal to the top minnow. So important does Professor Moore consider the work of fish in keeping down mosquito production that he says: "It may safely be said that were these fish suddenly wiped out, mosquitoes would immediately and generally become an intolerable nuisance."

## River Intake Difficulties

**Report on extension of the water supply of Memphis points out that cost of construction and operation of an intake in the Mississippi river, with other disadvantages, practically place river water out of the question for the present**

A report on the development of the water supply of Memphis, Tennessee, has recently been submitted by Fuller and McClintock, consulting engineers, which, among other points, considers the obtaining of a supply from the Mississippi river. The quantity and quality of the Mississippi water present no unusual difficulties, but they report that "the construction of safe and reliable intake works and intake conduit would be more difficult and costly than any similar existing works on American rivers."

The river level at Memphis has a range of 46 feet between extreme low and extreme high water; firm foundation for an intake cannot be found at less than 100 feet below mean water level, and owing to the extreme height of floods, the intake would have to extend at least 50 feet above this level, giving a total height of the intake structure of at least 150 feet. It is be-

lieved that no reliable intake structure could be maintained except a substantial masonry pier founded on a caisson and carried to a depth of about 100 feet, where a stratum of hard clay is found, which is that upon which bridge piers at Memphis are founded. On top of the pier proper would be placed a superstructure containing living quarters for the intake keeper and devices for operating the intake, screens and gates.

Even with this substantial and expensive structure completed, there is no guarantee that it would continue serviceable for many years. The Mississippi river, which is notoriously unstable throughout its entire length below the mouth of the Missouri, has given examples of its freakish behavior at or just above Memphis. Opposite the northern part of the city is a bar where, prior to 1912, there was 60 to 80 feet of water at ordinary stages, the flood of 1913 having deposited about 80 feet of material over an area of many acres. At another point about two square miles of the old bed of the river, where there was formerly 5 to 50 feet of water, is now well above mean water level, while the river cut a new channel approximately 45 feet deep through the westerly end of an island, removing about half a square mile of land, parts of which were 25 feet above mean river level.

With these possibilities of channel changes, it is evident that there can be no guarantee that an intake structure located in the present channel will not, perhaps next year, perhaps 50 years hence, be buried by a sand bar and rendered absolutely useless. The engineers find no place within twenty miles north of the city where a pier could be located with assurance that it would not at some time be buried in a river deposit or perhaps abandoned by the river entirely. They find, however, that directly opposite the city, between the railroad bridges, there is a section relatively narrow and confined between the bluffs of Memphis on the one side and Hopefield Point with its protection works on the other, where the flood velocity is too high to permit of extensive bars forming and where the various commercial interests make it imperative to maintain this reach of the river in substantially its present position. This they believe is the only place practicable for an intake pier, since below this it would receive pollution from the city's sewers. Even here the intake conduit from the intake pier to the shore would have to be at least 100 feet below low water level, built in a tunnel driven by compressed air.

The idea was suggested of placing low-service pumping machinery upon a floating barge and delivering water through a flexible pipe line supported by floats to the end of a permanent pipe line on shore. The engineers, however, do not consider this either reliable or practicable, one objection being that readjustments of the positions of barge and floats would require shutting down for periods longer than could be tolerated.

They estimate that an intake pier at this point would cost about \$1,000,000, while the tunnel would cost somewhat more than \$1,000,000.

The intake might be constructed opposite the



southern part of the city, where the greatest security against channel changes would be found, but would here be subject to pollution by the city's sewers and the cost would be greater than for the location above described owing to the longer distribution mains needed as well as the cost of intercepting sewers to carry the sewage below the intake as far as possible.

In addition to the matter of cost, they anticipate that considerable trouble would inevitably be experienced at times due to clogging of the river intake and conduit by ice and sand. Also the river water would be appreciably harder than the present well supply unless softened at considerable expense, and in summer it would be warm and relatively unpalatable.

For this reason the engineers advise continuing the use of artesian wells rather than drawing upon the Mississippi river.

## New Method of Purifying Water\*

By H. W. Clark †

**Lawrence Experiment Station loads a slow sand filter with aluminum hydroxide and secures good results at low cost for chemicals.**

Probably the chief objection to slow sand filtration in the minds of many sanitary engineers and water works officials is that this method of water treatment seldom removes from the comparatively clear but often highly colored waters of the eastern states more than from 25 to 30 per cent of this color, and hence does not produce a filtrate as clear, sparkling, low colored and altogether attractive as the filtrate from coagulation and rapid filtration of such waters. On the other hand, perhaps the chief objections to the method of coagulation and rapid filtration when applied to these soft, highly colored waters, are the tendency of this method to increase the corrosive properties of the soft water treated; the difficulty with which as good bacterial results can be obtained by it, generally speaking, as by slow sand filtration—especially if these soft waters are badly polluted; and the fact now again being widely commented upon that occasionally aluminum sulphate does pass through such filters.

Owing to these objections or criticisms of the two methods, a process of water treatment that will produce a sparkling water of low color without materially increasing its corrosive properties, has been much desired and such a method I believe we have worked out at the Lawrence Experiment Station of the Massachusetts Department of Public Health. I am calling this a new method although we have been experimenting with it since the latter part of 1916 and have published in our reports short summaries of the results obtained.

Briefly, the process consists of loading the sand

of a slow sand filter with the ordinary coagulants used in mechanical filtration and operating such a filter generally at slightly more than the usual sand filter rates, or about 5,000,000 or 6,000,000 gallons per acre daily. Filters loaded in this way remove a very large percentage of the organic matter, especially the coloring matter of the applied water and produce an effluent clear, sparkling and altogether attractive, containing no more carbonic acid than in the raw water applied to the filters and with the carbonate constituents of the water slightly increased.

This method of water treatment has many advantages over each of the other methods and but one drawback. The advantages are as follows: (1) The corrosive properties of the effluent are not increased or if so, not materially, and neither aluminum sulphate nor alumina is found in the filter effluent; (2) the aluminum hydroxide with which the filter is first loaded is regenerated whenever its color removal properties begin to fail and hence is used over and over again, that is, the primary cost of coagulants is practically the final cost; (3) when receiving comparatively highly colored water from storage reservoirs practically free from mineral matter in suspension, such as silt, etc., the method of filter regeneration or removal of stored color which we employ, removes practically all organic matter from the surface of the filter as well as from its deeper portions and hence the necessity for scraping the filter is largely obviated, that is, the expense of sand removal and sand washing is reduced to a minimum. Filters of this type now in operation at the Experiment Station have been scraped only once or twice during a period of five years' operation at rates of 5,000,000 gallons per acre daily; (4) there is, as I have already stated, practically no consumption of alum. Filters operated now for five years have theoretically used up-to-date, taking into consideration the amount of aluminum sulphate primarily placed in the filter and the volume of water filtered, about .2 of a grain of sulphate per gallon of water filtered or practically one-twelfth of the amount necessary per gallon in successful mechanical filtration of the Merrimack river water such as applied to these loaded filters. As the loaded filter increases in age and the volume of water filtered and decolorized increases, the theoretical or apparent use of alum grows less and less per gallon. Successful mechanical filtration of Merrimack river water costs in the neighborhood of \$6 or \$7 per million gallons for aluminum sulphate while with this new method the cost to date has been about 55 cents per million gallons for this sulphate, and this cost is constantly growing less; that is to say, if in the next five years we filter as large a volume of water as in the past five and without additional loading of the filter, the cost will be 28 cents per million gallons.

Up to date, we have operated eleven filters loaded with aluminum sulphate, but for purposes of this paper, the results of only five or six need be given. One filter, put into operation in January, 1917, and constructed of 4½ feet in depth of sand with an effective size of .25 millimeter, was loaded with 80 tons of aluminum sulphate per acre of filter surface. The aluminum hydroxide was precipitated in the sand by flooding the filter alternately with small

\* Paper before the New England Water Works Association.

† Chief Chemist, Massachusetts Department of Public Health.



doses of solutions of soda ash and sulphate, although the filter can be loaded by mixing an alkali such as magnesium carbonate with the dry sand and then applying solutions of the sulphate.

During its five years of operation the average color of the effluent from this filter has been 14 and the color of the water applied to it, 41—a removal of 66 per cent. During long periods the color of the effluent has averaged 7, however, and during portions of these periods the applied water has had a color of 60, 70 and even 75; that is, the filter has given an average color removal during such periods of about 90 per cent. In other words, the color line of the effluent has always been nearly straight while the color of the applied water has had many high peaks and the higher the color of the applied water the greater the percentage of the coloring matter removed.

Some Results Obtained at the Lawrence Experiment Station  
During 1917-1922

Rate of each filter 5,000,000 gallons per acre daily.

	Filter Number					
	494	512	513	514	515	516
Tons of aluminum sulphate per acre precipitated in filter	80	75	75	150	150	225
Color removed (per cent).....	66	73	73	73	78	76
Number of days between caustic treatments .....	65	67	67	89	89	90
Grains of caustic soda used per gallon of water filtered..	.52	.21	.42	.16	.32	.16
Approximate percentage of wash water .....	2.5	3.7	3.7	2.8	2.8	5.5

Up to date, this filter has removed rather more than 50 per cent of the organic matter determined as albuminoid ammonia and 60 per cent of that determined as oxygen consumed. It has been treated with weak solutions of caustic soda twenty-four times in five years in order to remove the coloring matter held in the filter by the aluminum hydroxide. After this treatment with caustic such a filter is washed with a volume of water equal to about 2.5 to 3 per cent of that filtered between treatments and is then ready for service for a period of two or more months. It is not necessary to use filtered water for this washing out of caustic. The amount of caustic used up to date in the filter described has been .5 of a grain per gallon of water filtered, or, in other words, the expense for the caustic used has been about \$2.50 per million gallons of filtrate. We believe, however, judging from later results, that we have used in this particular filter an excessive amount of caustic and that this figure may be much reduced.

A filter loaded with 150 tons of aluminum sulphate per acre has given an average color removal of 78 per cent during the past two years when operated at a 5,000,000-gallon rate and a filter constructed of sand as fine as .11 millimeter effective size and operated at a 2,500,000-gallon rate, has produced an absolutely colorless effluent since first put into operation. The cost of efficiently loading an acre filter is a small percentage of the cost of filter construction.

The bacterial results from this method are poor, as the caustic used removes from the sand grains much of the gelatinous organic matter so necessary for the retention of bacteria, but the effluent—clear, low in color and sparkling—is easily rendered prac-

tically sterile by the use of small amounts of chlorine, and chlorine is in almost universal use at filter plants at the present time in order that their effluents may be absolutely safe.

This method of treatment is particularly applicable to stored waters of a high color, the improvement of which physically is of more moment than the reduction of bacteria and it has seemed to us that there is no serious objection to it which would prevent its use upon a large scale. Recent experience has shown that perhaps the better way of loading the sand would be to carry this loading process on in comparatively small tanks or bins and then transport the sand to the filter. By this method more even distribution of the hydroxide would be obtained and stratification prevented.

In the discussion of the paper by the convention, Mr. Clark said that a more uniform distribution of the aluminum hydroxide might be obtained by dosing the sand in small tanks and then removing the coated sand grains to place in the filter; or the sand could be placed in the filter in successive layers, each layer being treated before the next is placed.

The PH (hydrogen ion) value of the filtered water is found to be increased. In reply to other questions, Mr. Clark said that the drawback to this process was the low percentage removal of bacteria—65. In preparing the solutions for treating the sand, he dissolved, for small filters, 6 pounds of aluminum sulphate in 50 gallons of water, and a little less than 3 pounds of soda in the same amount.

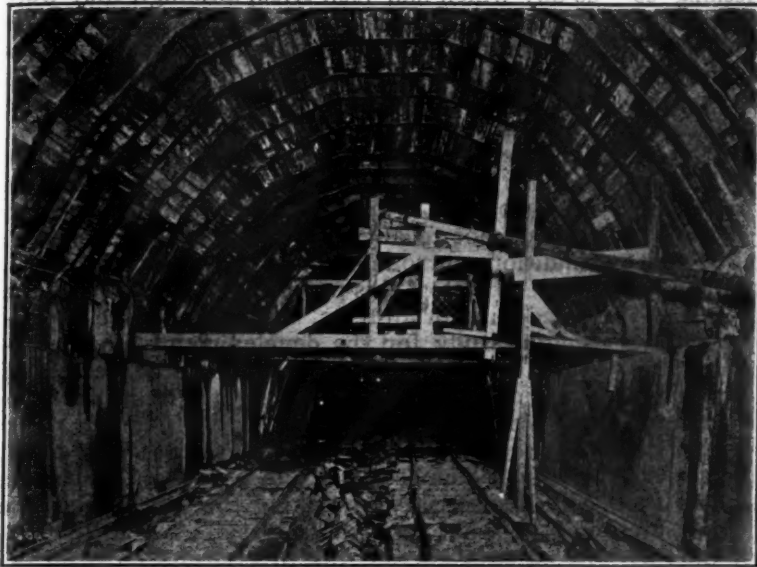
F. W. Green stated that he expected to try the process at the Little Falls filtration plant. Stephen De M. Gage stated that the process would apparently be of special value for Rhode Island cities, since physical improvement is more important than bacterial to the water supplies of that state with the exception of that of Providence.

## Concreting Liberty Highway Tunnels

**Placing about 9,000 yards of concrete in more than two miles of wide vehicular tunnels from four portals at average rate of 181 yards per day with dump cars, shoveling, and pneumatic process**

The Liberty tunnels, Pittsburgh, which were described in PUBLIC WORKS, July 23, 1921, are parallel twin structures 59 feet apart on centers with horse-shoe-shape cross-sections with an interior height of 27¼ inches and width of 26½ inches, length of 5,715 feet and a continuous grade of 0.4 per cent from end to end. The concrete lining, 24 inches thick, has a semicircular arch, slightly curved side walls and a thin concrete floor. Each tunnel contains an electric railway, a 13½-foot driveway and a 4-foot sidewalk, all for one-way traffic.

Alleghany County, Pennsylvania, awarded the contract to Booth & Flynn, who have nearly completed the work, at the price of \$722 per linear foot. The work involved about 127,000 yards of excavation and 9,000 yards of concrete. The tunnel was driven through loose rock, soft shale and clay, some of which weathered badly and required immediate timbering. The tunnels were driven from



STEEL FORMS, DELIVERY PIPE AND WORKING PLATFORM IN PLACE FOR PLACING CONCRETE BY PNEUMATIC PROCESS.

all four portals, using the top heading and bench method, with practically continuous work in two shifts; first drilling from 7 to 11:30 p. m., blasting from 11:30 to 2 a. m., and mucking from 2 until 4:30 a. m. for the night shift, while the day shift set the timber wall plates in headings from 7 to 8:30 a. m., erected the heading timber from 8:30 a. m. to 1:30 p. m. and mucked from 1:30 p. m. to 4:30 p. m. Other shifts concreted from 7 p. m. to 6 a. m., and from 7 a. m. to 5:30 p. m. moved, set and fitted concrete forms.

The permanent timbering bents each consisted of seven segments made up of  $32\frac{1}{2}$ -pound, 8-inch steel H-beams, 6 feet apart on centers, set on the timber plates and covered with 3-inch lagging. The steel bents were connected by tie rods and timber joggle blocks.

The headings were drilled with about 36 holes, 13 to 16 feet deep, and the bench with 16 to 20 holes in 12 lineal feet. They were blasted with about one pound of 40 per cent. dynamite per cubic yard, and the mucking was done with Marion No. 41 shovels having one and one-half yard dippers and operated by compressed air. The muck was loaded into 4-yard side-dump Western cars, hauled in six-car trains by an 8-ton 16-inch gauge electric mine locomotive, delivering them at the portal to 50-ton Climax steam locomotives, which hauled them to the dump.

The construction, largely piece work, was well organized and progressed at an average rate of 12 linear feet per day.

The 1:2:4 concrete is made with Alleghany river sand and gravel and Portland cement. Every load of aggregate is tested for organic matter and for loam. At the south end of the

tunnels the materials are delivered by railroad to a  $\frac{3}{4}$ -yard Ransome mixer and at the north end by truck to a one-yard Foote mixer, both mixers delivering to steel side-dump cars, which are hauled in five containers to the forms by electric locomotives.

The lining is poured in three successive operations. There is required for each linear foot of the tunnel 1.02 yards of concrete for the footings, 1.46 for the sidewalks and 5.08 for the arch. The daily progress is about 24 feet per section, amounting to 181 cubic yards at each point. That is a record of 325 linear feet of arch concreted, and placing 1,700 cubic yards of concrete in one week.

The steel sidewall form has a plank decking across the top just above the spring line, and is attached to a traveling steel inclined track 80 feet long. The concrete cars are pulled up this incline by a cable operated by one of the electric locomotives running on the invert tracks. The concrete is dumped onto the decking and shoveled behind the sidewall form. The footing sections are poured just ahead of the sidewall sections. At the same time that the sidewall concrete is being shoveled into place, the concrete from the front end of the decking is shoveled into wooden chutes leading down into the footing forms, so that these two sections are poured simultaneously. It usually requires about four hours to pour a 24-foot length of each of these two sections. The concrete is mixed as dry as workable and requires considerable spading for this reason. The spades are perforated with 10 or 12 holes  $\frac{1}{2}$ -inch in diameter, in order to secure a good finish.

The arch concrete is blown into the form by a  $\frac{1}{2}$ -yard Ransome pneumatic concrete blower which



SECTION OF FINISHED LINING, WITH BULKHEAD BRACED AGAINST ARCH BEAMS.



is installed under the side-wall form decking so that it moves along as the form is moved. The side-wall form decking is fitted with a small trap door so that if arch concrete is being placed, the cars are dumped onto the decking as in pouring side-walls and footings, while the concrete is shoveled into the blower through the trap door.

The concrete is blown about 100 feet with 80 to 100 pounds air pressure through a 6-inch conveying pipe, inclined up from the bottom of the blower to the crown of the arch. A special branch tee of manganese steel is used on the end of the discharge line, distributing the mix to each side of the arch simultaneously. The wooden joggle blocks between the steel segmental roof rings are removed before concreting while the steel tie-rods are left in place, and to these the steel arch reinforcement is securely wired.

The grout pipes through the steel lagging are extended through the form section to the skin of the form, while holes are cut in the lagging to insure the absolute filling of each ring section of arch by the pressure grouting performed later.

## Tests for Granite Paving Blocks\*

By Clarence D. Pollock†

**The value of the present tests in determining the probable wear in pavements. French coefficient the only one giving reliable information.**

In studying the present tests for granite in determining its suitability for paving blocks it may be well to study the history and development of these tests.

At first no tests were made, but the blocks were cut, paved and simply submitted to the service test. Architects had required the test for crushing strength of granite which was to be used in building construction. Some of the engineers thought that a test should be called for and knowing of the architects' test, they inserted this in the specifications. Various minimum requirements were used, varying from 15,000 pounds per square inch up to even 30,000 lbs. per square inch. When the minimum requirement was much over 15,000 lbs. it was found that many granites which had proved very satisfactory under the service test for long periods were barred out. A study showed that no very definite relation could be found between this test and the behavior of the granites under the actual traffic conditions. In 1915 this society adopted specifications with tests for impact or toughness and the abrasion test or French coefficient of wear including minimum requirements for moderately heavy traffic and heavy traffic.

At that time these tests seemed about as fair

as any which had been tried, although they were not devised for this purpose. Since then, from observation of results obtained in laboratories and results in the pavements it has been difficult to find much relation between these tests and the actual service test in the streets.

These two tests were designed to measure the relative resistance to impact and wear of broken stone for use in macadam road pavements, and they do not to any great degree fit in with the conditions surrounding the use as paving blocks.

The object of this paper is not to advocate the abandoning of all tests, but to encourage experimental study for the developing of more practical tests by calling attention to the defects of those now used in the testing of granite for paving blocks.

In the toughness test the sample is very small, one inch diameter and one inch high, and great care is necessary in making the sample or there will be wide variation in results. A little carelessness in making the test specimens from the same sample may result in an error equivalent to 25% of the total range of all granites used in the Eastern portion of the United States. This chance for error detracts greatly from the value of the toughness test, aside from the fact that it is a test that does not approximate the wear conditions in the street.

### FRENCH COEFFICIENT OF WEAR

In the test for French Coefficient of wear also the error may be as great as 25% of the total range of the granites, due to the method usually used in breaking the test pieces with a hammer which may start incipient fractures and also because of the irregularity of the shapes of the pieces for the test.

The Bureau of Public Roads has developed a machine for breaking out the test pieces by pressure which obviates the fault of incipient fractures and produces more regular shapes, but this cuts down the range of results on the various granites and makes it more difficult to differentiate the various granites.

This test does, however, show whether there is any real disintegration or not. The old idea that discoloration indicated disintegration has been thoroughly exploded. Discolored or "Sap" stone may in many cases show a greater strength than the clear stock from the same quarry. Real disintegration will show up in this test and herein lies its chief value in giving the relative strength of specimens from the same quarry, although it is not of much value beyond this in indicating how it will wear when paved in the street.

With the object of improving the present test for French Coefficient of Wear for granite block pavements, the laboratory of the Bureau of Public Roads has made modifications in the methods of preparing the test pieces for the Deval abrasion test as previously stated, the samples being broken into small cubical blocks by means of a machine instead of by hand. The machine consists of a 20-ton forcing press such as is used in automobile repair shops for forcing the gears

\*Paper before American Society for Municipal Improvements.  
† Consulting Engineer, New York City.



from shafts. This press is equipped with both stationary and movable knife edges and it has sufficient power to break a standard 5-inch granite block. This machine breaks the block into small cubes rapidly and much more accurately than can be done by hand and in addition avoids the danger of starting incipient cracks in the stone. In other words, the test pieces have good, clean, fairly regular faces and are approximate cubes.

Abrasion tests upon these fragments showed a greater coefficient of wear than the old method, but the results checked much better, although the range in values obtained with the different granites was much more limited than with the hand broken specimens. In order to increase this range, Mr. Jackson tried a modification of the abrasion test which was proposed by Messrs. Scofield, Mattimore and others, as follows: A number of longitudinal slots, each 1/16 of an inch in width, were milled in the abrasion cylinder, and the test was run on granite from 12 representative quarries making two or three tests on each kind of granite. Tests were also run on these same granites using the present method, and the results were compared. The elimination of the dust cushion gave lower coefficients of wear but the maximum variation of check tests was much less. In general, the coefficients of wear were somewhat over two points lower than with the present standard apparatus.

The total number of tests made was not sufficient to draw definite conclusions as to what minimum coefficient should be specified, but the maximum variation in check was sufficiently low to indicate that this was a step in the right direction. It is urged that more tests be made along this line and if they prove as consistent as those already made by the Bureau of Public Roads and several other laboratories, it may be possible to select definite minimum requirements to be used with these modifications in this test which will be an improvement on the present standard so that this test may be much more satisfactory than at present. This test is valuable as a means of proving whether a granite is disintegrated to any extent or not.

#### ACCELERATED TRAFFIC TEST

Several years ago the Bureau of Public Roads constructed 19 sample sections of granite block pavement from different quarries using different forms of filler and cushion and tested them by an accelerated traffic test which consisted of a machine having a frame carried upon rails which were parallel and on either side of the sample sections of pavement. These rails were supported firmly by concrete stringer or beams which also formed the sides of the pavement sections being tested. The subgrade was natural earth on a side hill having a gentle slope. Upon the subgrade 18 inches of rammed cinders were placed and then 8 inches of Portland cement concrete was deposited. On this foundation were constructed the various cushions and the test sections of granite pavement. In

the frame of the testing machine were cast-iron discs having a diameter of 4 feet which ran freely in the frame. This frame was drawn back and forth over the test sections by means of a cable. This is the nearest approach to a service test which has yet been devised. However, it was not possible to draw definite conclusions from the results obtained as there was more or less settlement of the concrete foundation, probably due to the large amount of cinders underneath it, and the narrowness of the pavement between the concrete foundations of the rails. It would seem as though some such form of practical test could be devised which would not be so cumbersome or expensive but that the laboratories could afford to use it.

An important point to be borne in mind in devising a better test is not so much how individual blocks will act under the test as how they will act when combined as in a pavement with the usual joint spacing and the different fillers in the joints.

A simple form of accelerated traffic test would be the ideal one and approximations of this are what should be aimed at in securing a more practical test.

In summing up the value of the laboratory tests now used to determine the wear of granites in granite block pavements, the conclusion is reached that the test for French Coefficient of wear is the only one of value and the principal advantage of this is to determine if disintegration has progressed sufficiently to render the stone unsuitable for use in pavements, provided the coefficient of the normal clear stock of that quarry is known. The value of this test will probably be increased by using the modifications as were tried by the U. S. Bureau of Public Roads.

In the test for abrasion it would be advantageous to use the percentage of wear directly rather than the French Coefficient, as in the lower percentages of wear the equivalent French Coefficients change greatly for small percentage changes.

#### Garbage Reduction in Dayton

A brief summary of the operation of the Dayton, Ohio, garbage reduction plant given in the annual report of the City Commission for 1921, states that the cost of operating the plant in 1921 was \$2.98 per ton of green garbage, as compared with \$5.24 in 1920. This reduction was possible on account of reduced cost of labor and material.

However, the reduction in the prices obtained for grease and tankage was much greater. Garbage in 1920 sold at 10¼ cts. per pound, while in 1921 eight cars were sold at 1.95 cents and five cars at 3.26 cents. Tankage sold in 1920 for \$10.43 per ton while in 1921 it was \$7.08. Had the 1920 prices for grease and tankage prevailed during 1921, the total revenue from the sale of grease and tankage would have been approximately \$85,000, whereas the total revenue actually received was about \$21,500, a little more

than one-quarter as much. As the cost of operating the plant, including labor, supervision, hire of equipment, repairs, materials, etc., amounted to about \$51,000, there was a loss in operation of about \$29,500 in addition to the charges for interest and depreciation and other overhead expenses. Much better prices are being obtained this year and it is hoped that the amount received will be at least sufficient to pay the operating expenses. This experience at Dayton was that of all cities operating reduction plants, for which plants the year, 1921, was the most disastrous one that has ever been experienced in the history of garbage reduction.

## State Indebtedness for Public Works

**Figures for the bonded indebtedness of each of the states, two-thirds of which was incurred for highways, waterways and other public works.**

The total bonded indebtedness of all the States aggregates a little over One Billion Dollars, and a little more than one-third of this was incurred for the construction of highways and bridges, while another third has been expended on other physical improvements such as waterways and harbors, park systems, etc.

This State expenditure for public improvements of course does not include all of the money spent in the State, by any means, but only that paid for by State funds. In most, if not all of the States, the additional amounts raised for this purpose by counties, cities and other political divisions, exceed that raised by the State. The relation between State-raised funds and other funds devoted to public works varies largely in the different States. In one extreme lie the States of Kansas, Kentucky and Nebraska with no bonded indebtedness whatever, Indiana with only \$340,000 bonds raised for Purdue University, and Ohio with its only bonded indebtedness that devoted to "adjusted compensation" for World War Veterans; while at the other extreme lie Massachusetts with a total of \$138,000,000, large items of which are sums devoted to abolition of grade crossings, metropolitan parks, sewers and water, and State highways; and New York with nearly \$155,000,000 for canals, \$100,000,000 for highways and about \$13,000,000 for parks and miscellaneous purposes.

Considering the total indebtedness for all purposes, we find New York State leading with \$267,784,000, or just about one-fourth of the entire total for the forty-eight States. Next comes Massachusetts with a little over \$138,000,000, with California third with \$73,683,000.

The total bonded indebtedness for highways is \$367,687,000, which is distributed among twenty-three States, slightly more than half of the States having issued no bonds for this purpose. The highest bonded indebtedness for highways is that of New

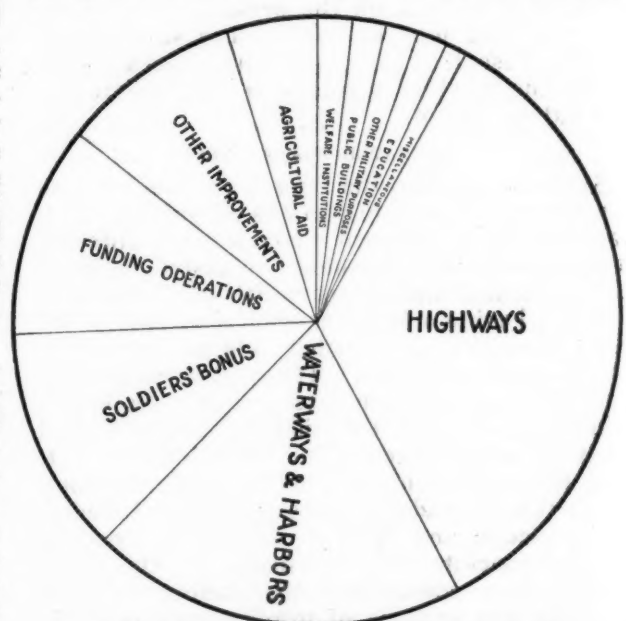
York, which is followed by California with \$55,000,000, Pennsylvania with \$50,000,000, Oregon with \$31,700,000, Maryland with \$19,877,000, and Massachusetts with \$19,114,500.

It is somewhat surprising to note that the State indebtedness for water ways and harbors is far larger than for any other purpose except highways, totalling \$213,891,400. This large State expenditure for this purpose, however, is accounted for largely by New York's indebtedness of \$154,800,000 for canals, only five other States having incurred any indebtedness for this purpose; the next largest sum being that of Louisiana, \$31,989,400.

These figures have been obtained and compiled by the Bank of America of New York City and were furnished, except in a few instances, by the State officials in direct charge of financial operations and are, therefore, believed to be reliable and complete. "The variety of record-keeping methods followed in the different States and the varying technical understanding of the term 'State debt' has made it somewhat difficult to lay down standard rules for compilation and to adhere to them strictly. As far as possible, the interpretation of the officials giving the information has been followed as to what constitutes indebtedness. But some modifications have been necessary to achieve a degree of uniformity to make the information at all comparable. The data include only 'bonded indebtedness,' items of current or floating indebtedness having been excluded."

The figures apply only to gross outstanding debt. "The absence of uniformity in the various State treasury offices in handling sinking fund or other arrangements for retiring the debt, as well as different interpretations of the records of such operations, has made it inadvisable to attempt to determine the net debt."

The figures given are, in the majority of cases, approximately correct for the end of 1921 or the Spring of 1922, some time, of course, having been required for obtaining the information and for compiling that obtained. In some cases, however, the



THE PURPOSES OF STATE INDEBTEDNESS



figures are not quite so recent, those for Louisiana being as of Jan. 1st, 1920, and derived from authentic sources, but not from the State auditor or treasurer, as is the case with most of the figures.

An examination of the date of issue of the bonds shows that almost one-half of the existing debt has been incurred since the United States entered the War and over one-third since the beginning of 1920, although only a small part of this has been directly caused by the war itself. For instance, \$38,000,000 of California's indebtedness for highway construction has been issued since July 1st, 1917, all of Illinois' \$11,000,000 road bonds have been issued within the past twelve months, as have \$10,000,000 of Michigan's highway bonds and a considerable part of those of several of the other States. More than one-third of the total amount of bonded indebtedness has been incurred since June 1st, 1920.

In connection with the large sums raised for highways, it is to be remembered that a large proportion of these sums have been matched by nearly equal amounts contributed by the Federal Government under the Federal Aid Plan for highway building. Vast as seem these sums, the per capita debt of the States for highway development amounts to only about \$3.50.

The largest individual item in any classification is the \$154,800,000 with which New York State has been financing its canals. Only second in magnitude is the \$83,775,162 spent by Massachusetts on the transit, water, sewer and park systems of the metropolitan district. Including the highways and bridges, waterways and harbors, park systems, etc., the actual physical improvements represent between 65% and 70% of the total State indebtedness.

"A close chronological study of the issues shows

#### Bonded Indebtedness of States Devoted to Public Works.

	Total Debt	Public Buildings	Highways	Waterways and Harbors	Other Improvements
Alabama	\$8,557,070.00				
Arizona	3,913,275.29	\$42,000.00			
Arkansas	2,538,166.67				
California	73,683,000.00	5,600,000.00	\$55,000,000.00	\$13,083,000.00	
Colorado	6,554,500.00		2,000,000.00		
Connecticut	16,291,100.00				
Delaware	4,880,785.00		3,929,000.00		
Florida	601,567.00				
Georgia	5,530,000.00				
Idaho	5,989,000.00	1,650,000.00	3,623,500.00		\$80,000.00
Illinois	11,017,500.00		11,000,000.00		
Indiana	340,000.00				
Iowa	260,000.00	260,000.00			
Kansas					
Kentucky*	5,312,438.77				
Louisiana	42,559,900.00		657,000.00	31,989,400.00	
Maine	10,883,300.00		6,264,500.00	650,000.00	
Maryland	30,475,880.55		19,877,000.00		1,000,000.00
Massachusetts	138,049,134.53	2,090,000.00	19,114,500.00	12,393,000.00	83,775,162.00
Michigan	45,550,000.00		17,050,000.00		
Minnesota	19,435,800.00	441,000.00			65,000.00
Mississippi	6,994,899.00				1,948,899.00
Missouri	20,598,839.00	1,200,000.00			
Montana	4,103,000.00	724,000.00			
Nebraska					
Nevada	1,669,000.00	68,000.00	610,000.00		
New Hampshire	2,490,500.00		226,000.00		
New Jersey	17,116,000.00		5,000,000.00		
New Mexico	3,853,500.00	185,000.00	940,000.00		
New York	267,784,000.00		100,000,000.00	154,800,000.00	12,929,000.00
North Carolina	27,732,600.00	3,622,000.00	8,052,600.00		1,142,500.00
North Dakota	4,703,300.00				
Ohio	20,000,000.00				
Oklahoma	4,722,900.00				
Oregon	42,695,125.00		31,700,000.00		
Pennsylvania	50,658,320.26		50,000,000.00		
Rhode Island	11,032,000.00	2,213,000.00	2,563,000.00	976,000.00	550,000.00
South Carolina	9,575,120.87	6,523.28			
South Dakota	47,700,000.00		3,750,000.00		
Tennessee	15,226,000.00	100,000.00			60,000.00
Texas	4,002,200.00				
Utah	10,035,000.00	1,850,000.00	7,260,000.00		
Vermont	1,675,500.00	140,000.00			
Virginia	19,380,337.57				
Washington	12,500,000.00				
West Virginia	26,427,500.00		15,000,000.00		
Wisconsin†	2,275,991.77				
Wyoming	4,133,000.00	63,000.00	4,070,000.00		
	\$1,071,506,981.28	\$20,254,523.28	\$367,687,100.00	\$213,891,400.00	\$101,550,561.00

\*Outstanding warrants (not bonded indebtedness).

†Certificates of indebtedness to School and Normal Funds of State (not bonded indebtedness).

"Highways" includes bridges and grade crossing elimination.

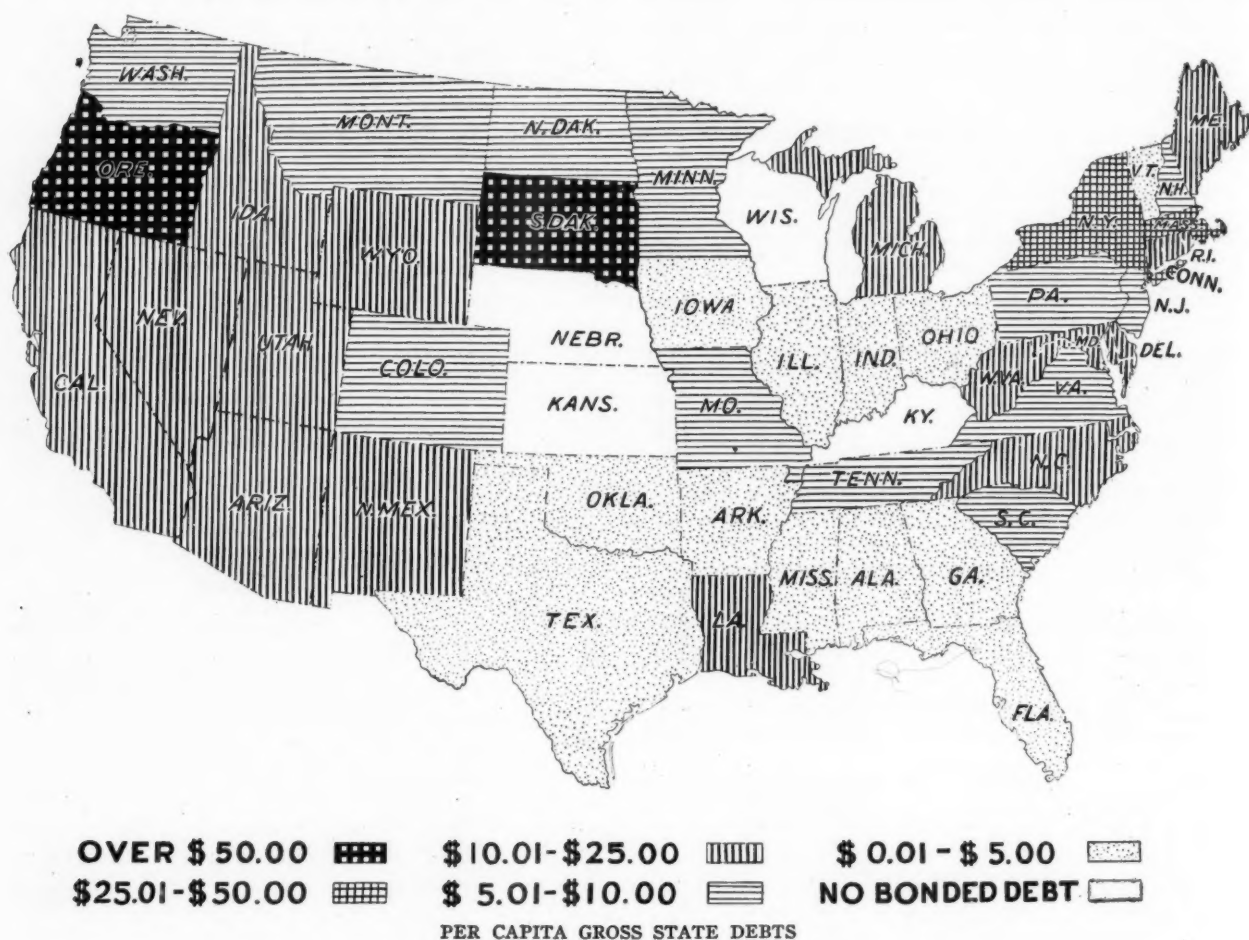
"Other Improvements" includes physical improvements other than highways, waterways or buildings.

that lump sum bond issues for a variety of purposes are decreasing in popularity, bond issues now more often being voted upon for specific purposes. The practice of funding into long-term obligations, floating debts incurred for minor purposes or even current expenses and annual operating deficits, appears to be almost extinct. This may certainly be considered an indication of the trend toward more scientific business control of State finances."

For the above figures and quoted comments and illustrations we are indebted to a pamphlet published by the Bank of America, entitled "A National Survey of State Debts and Securities." This pamphlet gives the itemized statement of each bond issue for

fish hatchery on Ten Pound Island in Gloucester Bay. The suspected water was the drainage from the roof of the station building collected in a cistern of about 4,500 gallon capacity, made of brick and cemented on the inside.

The investigation indicated only three possible sources of contamination, a 6½-foot length of lead pipe which, however, had been removed in July, 1920; lead paint that may have gotten into the gutters or drains; and lead flashing at three places on the roof. As the cistern had been emptied and cleaned since the lead pipe was removed, this cause seemed to be out of the question, as did also lead in paint, since lead in paint



each of the States, its date of issue, amount, purpose, interest rate, date of maturity and the amount retired. It also gives and discusses the various classifications other than public works, such as welfare institutions, agricultural aid, soldiers' bonus, etc.; but we have touched upon only those purposes included in the general term of "public works," to which, as already stated, has been devoted about two-thirds of the total bonded indebtedness.

### Lead in Cistern Water

The U. S. Public Health Service a few weeks ago was requested by the U. S. Employees Compensation Commission to investigate the cause of lead contamination of the cistern water at a

is highly insoluble in water. It seemed to be demonstrated by elimination, therefore, that the lead in the cistern was derived from about 17 feet of strips of lead flashing on the roof. The possibility of lead reaching the cistern from this source is indicated by the regulations of U. S. Lighthouse Service for 1911, which contained the following: "To purify rain water contaminated with chloride of lead from salt spray resting in the leads of structures, put a small quantity of pulverized chalk or whiting into the cistern and stir well after each rain."

As a result of this investigation it is recommended that lead be not used in the construction of roofs, the drainage from which is to be used for drinking purposes.



# Tabulated Sewerage Data

Supplementary data received since the publication, in the August issue, of figures received from several hundred city engineers in all parts of the country, giving the amounts and kinds of sewers laid during 1921 and 1922, jointing material used in pipe sewers, and other details.

## Large Sewers Built in 1921 and 1922

	Brick Sewers		Concrete Sewers Without Reinforcement		Concrete Sewers With Reinforcement		Segment Block Sewers	
	Dimensions	Length	Dimensions	Length	Dimensions	Length	Dimensions	Length
<b>California</b>								
Los Angeles.....	27"	1,611	....	....	18" to 24"	10,425.0	....	....
<b>Indiana</b>								
Indianapolis .....	....	....	....	....	18" to 24"	10,425.0	2'6" to 6'0"	13,365
Kendallville .....	....	....	....	....	....	....	33" & 30"	3,200
<b>Massachusetts</b>								
Amesbury .....	18" & 24"	....	....	....	....	....	....	....
<b>Michigan</b>								
Battle Creek.....	22"x33" to 39"x58"	30,613	....	4,180	....	1,404	....	6,821
<b>New York</b>								
Johnson City .....	....	....	....	....	27"—30"	9,466	....	....
<b>Ohio</b>								
Canton .....	96" to 30"	18,244	....	....	....	690	....	....
Dayton .....	....	....	30" to 108"	25,000	....	....	....	....
Middletown .....	....	....	....	....	6'3"x4'4"	4,932	....	....
<b>Texas</b>								
Wichita Falls.....	....	....	....	....	....	....	30" to 80"	32,915
<b>Washington</b>								
Tacoma .....	....	....	....	13,527	....	13,830	....	....

## Details of Sewers Laid in 1921 and 1922

City and State	Sanitary sewers, feet	Storm sewers, feet	Combined sewers, feet	Surface water inlets	
				With catch basins	Without catch basins
<b>Alabama</b>					
Talladega .....	....	....	....	40	....
<b>Arkansas</b>					
North Little Rock.....	2,435	11,290	....	....	63
<b>California</b>					
Los Angeles .....	422,546	....	....	....	....
Santa Ana .....	30,600	....	....	....	....
<b>Connecticut</b>					
Meriden .....	3,364	300	....	....	....
<b>Indiana</b>					
Indianapolis .....	110,545	20,230	75,000	180	96
Kendallville .....	70,000	17,000	58,000	....	....
Marion .....	2,500	1,500	....	12	....
<b>Iowa</b>					
Le Mars .....	7,061	....	....	....	....
<b>Massachusetts</b>					
Amesbury .....	1,500	....	....	....	....
Newton .....	18,523	....	....	5,000	....
<b>Michigan</b>					
Battle Creek .....	289,505	28,076	2,952	36	417
<b>Nebraska</b>					
North Platte .....	33,200	....	....	....	....
<b>New Jersey</b>					
Clifton .....	....	....	....	17	....
Millville .....	5,660	6,300	....	103	....
Rutherford .....	3,200	300	....	8	60
<b>New York</b>					
Gloversville .....	2,171	....	....	536	....
Johnson City .....	....	....	76,703	....	....
<b>Ohio</b>					
Canton .....	80,737.2	21,232.3	....	350	....
Dayton .....	53,000	23,000	....	....	....
Middletown .....	21,368	....	....	....	50
<b>Oklahoma</b>					
Ada .....	11,000	4,000	....	....	25
<b>Oregon</b>					
Eugene .....	....	....	....	50	10
<b>Pennsylvania</b>					
Freeland Borough ...	....	....	....	20	12
Jersey Shore .....	22,090	....	....	....	....
Munhall .....	....	998	....	6	....
<b>Texas</b>					
Wichita Falls .....	155,362	18,227	....	1	70
<b>Vermont</b>					
Springfield .....	....	....	900	5	....
<b>Washington</b>					
Spokane .....	....	....	....	50	....
Tacoma .....	7,724	5,903	13,730	....	....
<b>Wisconsin</b>					
Green Bay .....	....	....	8,392	40	....
New London .....	3,300	....	3,300	27	....
Oshkosh .....	7	....	....	2,300	....





# Recent Legal Decisions

## SEPARATE DEPARTMENTS OF MUNICIPAL PLANTS SHOULD CARRY OWN BURDENS

The Wisconsin Commission is of opinion that the electric consumers of a municipal plant should not be required to carry the burden of the water department. Each utility should stand upon its own feet. The larger portion of the operating expenses of the plants is chargeable directly to a particular utility and a particular class of service. The remaining expenses are common and must be apportioned between the utilities on a fair and reasonable basis.

## RIGHT TO OPERATE MUNICIPAL ELECTRIC LIGHT PLANT

The Illinois Appellate Court holds, *City of Sullivan v. Central Illinois Public Service Co.*, 221 Ill. App. 561, that a plaintiff who has never been given by ordinance the right to use a city's streets, and who purchased an electric light plant in the city while the city was operating and maintaining an electric light plant of its own, cannot claim that it is inequitable for the city to install and maintain such a plant of its own, but that it should grant the right to the plaintiff or purchase its plant.

## DAMAGES TO CONTRACTOR'S EQUIPMENT BY CONSTRUCTION OF DAM

In an excavation contractor's action against a river drainage district for damages to machinery and equipment by the backing up of water through the erection of a dam in the channel of the river by the district, the latter claimed that an independent contractor alone was liable. The Illinois Appellate Court holds, *Myers Construction Co. v. Wood River Drainage etc. District*, 221 Ill. App. 473, that the district could not escape liability on evidence that the dam was constructed according to plans and specifications furnished by the district and under its engineer's direct supervision. The proper measure of damages was held to be the rental value of the contractor's machinery and equipment and the damages incident to the tying up of its men.

## OPERATING EXPENSES AND TAXES OF MUNICIPAL PLANTS

In rate fixing cases involving municipal plants, the Wisconsin Commission says, in regard to taxes, interest and depreciation: "In estimating the costs for municipal as well as for privately owned plants, it would seem necessary to take into consideration the operating expenses, depreciation, taxes and interest on the investment. Operating expenses, including depreciation, are always present and must be actually met, no matter by whom the plants are operated. Taxes and interest charges may, in a sense, be dispensed with for municipal plants. That is, neither taxes nor interest may be actually assessed against such plants. On the other hand, taxes and interest charge are present in some form in all industrial activities. Water works represent property that is of value and in which money has been invested. They constitute a part of the capital of the city. If such items as fixed charges are not

considered by municipal plants in fixing rates for private consumers, it would seem that these consumers would be favored as against the taxpayers. There does not, on the whole, appear to be any equitable ground upon which such charges can be entirely eliminated in any industry or in connection with the service of any public utility." *In re City of Kaukauna.*

The laws of Wisconsin place a municipality, which owns and operates a public utility, under the same obligations as any other owner of a public utility. The Commission considers that the general functions of city government and the supplying of private needs should be kept separate and each be self-supporting.

## QUESTION WHETHER CITY ENGINEER HAD ARBITRARILY REFUSED FINAL APPROVAL HELD FOR JURY

The general rule in regard to contracts for public works is that where the ultimate liability is made dependent upon the approval of the engineer in charge, or his certificate, or his final estimate, the contractor cannot recover in its absence, unless he shows a waiver of the requirements, or that he was entitled to this certificate, and that it was arbitrarily refused. But where, in an action by a contractor there was evidence that there was no reasonable cause for dissatisfaction with any of the contractor's work, and that the engineer's refusal to give final approval was due either to a mistaken belief that he could not do so unless the service director approved, or else to an effort to shift to the service director the responsibility for the decision which the engineer was required to make, though there was evidence to the contrary, it is held, *O'Reilly v. City of Cambridge*, 279 Fed. 961, that a verdict for the city could not be directed on the ground that the engineer's final approval had not been given, the decision being for the jury.

## SCALE OF WAGES FOR CITY LABOR—DELEGATION OF COUNCIL'S POWERS

The Wisconsin Supreme Court, *Wagner v. City of Milwaukee*, 188 N. W. 487, holds that an ordinance which requires laborers employed on city work to be paid the prevailing wage of members of any labor organization, when approved by the members of the common council, and a resolution fixing a scale of wages accordingly, were void as being a surrender by the common council members of the exercise of their independent and individual judgments, and an agreement to be bound by the labor union scale if they acted at all on the subject. Any attempted vesting of the determination of such a legislative question in an outside body is an abdication, and not an exercise, of the legislative discretion that exclusively belongs to the common council itself. Three judges dissented, being of the opinion that the ordinance did not contain any delegation of legislative powers.

**CITY'S RIGHT TO REQUIRE SPECIFIED PUBLIC UTILITY RATES AFTER EXPIRATION OF FRANCHISE**

The Circuit Court of Appeals, Sixth Circuit, in *City of Louisville v. Louisville Home Telephone Co.*, 279 Fed. 949, holds that where a rate fixing public service franchise has expired, and where there is no inconsistent statute, the city has an optional right to eject the corporation from the streets, but, so long as the city requires the corporation to continue to give public service, it must allow compensatory rates; citing the *Denver Case*, 246 U. S. 178, the *Detroit Case*, 248 U. S. 429, and the *Toledo Case*, 259 Fed. 40.

A city ordinance, which refers to further service and rates, may indicate an intention that the service must be given at the rates named, or an intention that the streets must be vacated and the service abandoned unless the company accepts the rates named. The city has the right to impose this choice upon the company, and if that intent is sufficiently apparent the company cannot continue both to use the streets and reject the rates.

**SPECIFICATIONS FOR BIDS MUST FURNISH STANDARD FOR REAL COMPETITIVE BIDDING**

The New York Supreme Court, Special Term, Monroe County, holds, *Warnock v. Wray*, 194 N. Y. Supp. 396, that, under the New York Education Law, §875, subd. 8, requiring contracts to be let to the lowest responsible bidder, the specifications are required to be in such form as to furnish a standard for real competitive bidding upon a uniform and intelligent basis. Under this section specifications for the construction of a substantial amount of work either of wrought iron or steel pipe in the alternative, prices being substantially different, do not furnish a basis for genuine competition.

New York General Municipal Law, §51, authorizes an action to prevent an illegal act or a waste of public funds and an injunction will be granted in an action by a taxpayer against a board of education to enjoin the letting of a contract under such a form of bidding. With respect to the letting of contracts for the construction of school buildings, involving the use of municipal funds affecting the city taxpayers, the board is subject to statutory municipal control, and to an action by the municipality, or by a taxpayer in its behalf.

**RATES FOR PUBLIC FIRE PROTECTION SERVICE**

The Pennsylvania Public Service Commission is of the opinion that the special nature of public fire protection service and the wide variation in estimates of its cost, depending upon the viewpoint taken and upon the characteristics of the particular property, make a determination of the proper charge for this service more largely a matter of judgment resting upon estimates of cost and a careful consideration of the extent, nature and value of the service and conditions existing in a particular case. It is furthermore a service, the cost of which is less influenced by variations in operating costs. Public fire protection rates established by a water company may

be not unreasonable in form but in their application place an undue portion of the total burden upon the municipality. In the case of the *Waynesburg Water Company*, the Commission fixed as reasonable rates for this service \$13 per hydrant per annum and \$330 per mile of main 4 inches or greater in diameter.

**AWARD OF CONTRACT TO LOWEST BIDDER**

A mandamus will issue in the New York courts to compel a board of education to award a contract to the lowest bidder, the statute requiring contracts to be let to the lowest responsible bidder giving the security required, and there being no substantial reason for doing otherwise. *Arenomeyer—Warnock—Zarndt v. Wray*, 194 N. Y. Supp. 398. A reservation in a notice for bids in such a case of the right to reject all bids is not effective, where the contract is required by statute to be let to the lowest responsible bidder, and there is no statute giving such right in the discretion of the board, unless there is a substantial reason for rejecting all bids.

**TAXES CANNOT BE LEVIED FOR LIGHT FURNISHED TO ONLY ONE SECTION OF A CITY**

Considering an application for approval of a contract for the sale of electrical energy to the city of Gary, the Indiana Public Service Commission disapproved of a proposed clause in the contract under which the city would be required to levy taxes to pay for energy furnished to the city and resold to domestic consumers in a particular section of the city.

**GRADING CONTRACTS—DUTY TO SUPPLY GRAVEL—WAIVER OF TIME LIMIT**

In an action for balance due on a road grading contract the Arkansas Supreme Court holds, *Brown & Froley v. Monroe County Road Improvement Dist.*, 241 S. W. 39, that where such a contract does not provide that the road improvement district shall furnish gravel to the contractor to keep his forces steadily employed, and that a failure to do so will render the district liable in damages, it must be presumed that the parties contracted with reference to all the conditions confronting them at the time, such as weather conditions and the difficulty of getting sufficient gravel, and failing such an express provision in the contract, liability for a breach thereof could not be maintained.

A provision in the contract for liquidated damages on failure to complete the contract by a certain date was held waived by the acquiescence of the district's engineer in suspension of the grading because of unfavorable weather conditions.

**ADVANCES BY CONTRACTOR TO SUBCONTRACTOR UNDER AGREEMENT FOR REIMBURSEMENT FROM PERCENTAGE RETAINED**

The Circuit Court of Appeals, Eighth Circuit, holds, *Reeves v. McWilliams Co.*, 280 Fed. 100, that a drainage contractor, who advanced money to a subcontractor under the latter's agreement to reimburse him from the percentage of the contract price retained under the contract by the drainage district, had an equitable right and first claim on the percentage fund for reimbursement of the sum advanced.



## NEWS OF THE SOCIETIES

### CALENDAR

Oct. 1-8—AMERICAN SOCIETY OF CIVIL ENGINEERS. Opening meeting of the season. Subject, "Structural Engineering." Secretary, Harold M. Lewis, 33 West 39th St., New York.

Oct. 16-19—AMERICAN PUBLIC HEALTH ASSOCIATION. Annual meeting, Cleveland, Ohio. Secretary, A. W. Hedrick, 370 Seventh Ave., New York, N. Y.

Oct. 18—BOSTON SOCIETY OF CIVIL ENGINEERS. Monthly meeting at Tremont Temple, Boston. Secretary, J. B. Babcock.

Oct. 27—MINNESOTA SECTION, AMERICAN WATER WORKS ASSOCIATION. Fall meeting, Minneapolis.

Oct. 28—ENGINEERS' CLUB OF NORTHERN MINNESOTA. Eva. 8th, Minn.

Nov. 1-3—IOWA SECTION, AMERICAN WATER WORKS ASSOCIATION. Annual meeting, Iowa City and Cedar Rapids. Secretary, Jack J. Hinman, Iowa City, Ia.

Nov. 2-3—CENTRAL STATES SECTION, AMERICAN WATER WORKS ASSOCIATION. Annual convention, Pittsburgh, Pa. President, C. A. Finley.

Nov. 14—NEW ENGLAND WATER WORKS ASSOCIATION. Luncheon meeting, Boston, Mass.

Nov. 14-16—NORTH CAROLINA SECTION, AM. WATER WORKS ASS'N. Annual meeting, Gastonia, N. C. Secretary, Thorndike Saville, Chapel Hill, N. C.

Nov. 15-16—NATIONAL INDUSTRIAL LEAGUE. Annual meeting, New York City. Secretary, J. H. Beck, Chicago.

Dec. 7-13—NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING. New York City.

May 7-9—AMERICAN ASSOCIATION OF ENGINEERS. Ninth annual convention, Norfolk, Va. Secretary, C. E. Drayer, Chicago.

### AMERICAN SOCIETY OF CIVIL ENGINEERS

The opening meeting of the season of 1922-23 of the American Society of Civil Engineers will be held at the rooms of the society, 33 West 39th street, New York, at 8 p. m., Wednesday, October 18. As a preliminary to the regular meeting motion picture will be shown, 7:30 to 8:00 p. m., illustrating the Catskill Aqueduct.

M. Antoine, of Strasbourg, Engineer of the French Government, will give a short illustrated talk on the improvement of the Rhine and the Grand Canal d'Alsace, now contemplated to be executed by the French Government.

The widespread attention directed to the disastrous theater failures in Brooklyn and Washington makes this an opportune time to emphasize the importance of competent structural engineering in the construction of buildings. The structural engineer's duty in co-operation with others concerned in the making of a safe and suitable structure will be discussed by James B. French, Consulting Engineer of New York City; Rudolph P. Miller, Consulting Engineer of New York City (formerly Superintendent of Buildings, New York City); Hon. Lewis F. Pilcher, Architect, State of New York; Daniel T. Webster, Manager, Marc Eidlitz Sons, Contractors, New York City, and Lewis D. Rights,

Contracting Engineer, Shoemaker-Satterthwait Bridge Co., New York City; followed by open meeting talk by others interested. A short business meeting will be held during the evening.

At the meeting of the society on October 4th two papers were read and discussed, one on "Experiments with Models of the Gilboa Dam and Spillway," by R. W. Gaussmann and C. M. Madden, and the other on "Engineering Geology of the Catskill Water Supply," by Charles P. Berkey and James F. Sanborn.

The Board of Directors met in San Francisco on October 2 and 3. The board decided to hold the spring meeting in New Orleans at a date to be decided later, the topic for the meeting to be: Ports, Harbors and River Control. The following resolution was passed: "That this board is in sympathy with a movement to join the Federated American Engineering Societies when financial and other conditions permit," the matter to be discussed at the January meeting.

### ILLINOIS SECTION, AMERICAN SOCIETY OF CIVIL ENGINEERS

A dinner meeting of this section was held on Wednesday evening, September 20, in honor of the secretary of the society, John H. Dunlap. It was attended by over fifty local members. Mr. Dunlap, in his address, acquainted the local members with the plans and possibilities of the national society. The treasurer of the national society, O. E. Hovey, was present, and stated that the finances of the society are in excellent condition.

### CHICAGO ENGINEERS' CLUB

This club has recently elected the following officers: President, Homer E. Niesz; Vice-President, C. C. Brooks; Secretary, George H. Clucas; Treasurer, Vernon C. Ward; Trustees, George E. Waldo and Frank D. Chase.

### LEAGUE OF CALIFORNIA MUNICIPALITIES

The twenty-fourth annual convention of the League of California Municipalities was held at Stanford University and Palo Alto on September 19 to 22. Among the papers on the program were: "Budget Experience of California Cities," "Problems of a City Manager," "Garbage Collection and Disposal," "Getting Results in City Planning," "Palo Alto's Street Work Procedure," "The Boulder Canyon Project," "California's Water and Power Act," "Water Development in Sacramento, San Jose, Los Angeles and Santa Rosa."

### AMERICAN ASSOCIATION OF ENGINEERS

The quarterly meeting of the Board of Directors of the American Association of Engineers, held September 29 and 30, "demonstrated the practical results

that are to be had from the present form of organization whereby a director represents a defined district," in the opinion of A. N. Johnson, president of the association. At the board meeting sixty per cent. of the annual dues was assigned to the Michigan Division and Southwestern Division and to fifteen chapters rated as "Class A"; affiliations of the Detroit and Boston chapters with local technical societies were approved; charters were granted to the societies in Grand Rapids, Michigan, and Orlando and Palm Beach, Florida; provision was made for extension of membership among engineering students in colleges, and the National Legislative Committee was instructed to review the Model License Law of the association and make recommendations for modification by December 1 for the information of states planning to introduce bills in the 1923 Legislature.

### AFFILIATED TECHNICAL SOCIETIES OF BOSTON

The Bulletin of the Affiliated Societies for October announces meetings of the Boston Society of Engineers on the evening of October 18, where papers on bridges will be presented, illustrated by lantern slides. "The Construction of the Pre-cast Concrete Slab Bridge at Central Street, Lowell," will be described by S. Stanley Kent; "A Survey of Massachusetts Bridges" will be given by William F. Williams; "Strengthening Old Bridges" will be discussed by Lewis E. Moore, and "A Long-Span, Reinforced Concrete Girder Bridge at Cohasset Narrows" will be described by B. A. Rich.

On November 8 the Designers' Section of the Boston Society of Civil Engineers will hold a meeting, where "Handling Materials by Conveying Machinery" will be discussed by Nixon W. Elmer.

On November 10 will be held the regular monthly meeting of the Boston Chapter of the American Association of Engineers.

On November 14 the New England Water Works Association will hold a luncheon meeting at the Boston City Club, where Dr. Richard Moldenke will present a paper on "Iron Castings"; the U. S. Cast Iron Pipe and Foundry Company will show motion pictures of the centrifugal process of casting pipe, and S. R. Church, of the Barrett Company, will speak on "Tars."

On November 18 the Northeastern Section of the American Society of Civil Engineers will hold a luncheon meeting at the Boston City Club. This section held a luncheon meeting on September 9, which was attended by forty members and guests, the guests including members of the Executive Board of the American Engineering Council, who were meeting in Boston on September 8 and 9.

Preliminary plans have been made for the first affiliation meeting, to be held



on Thursday, November 23. The subject will be "Commercial Aviation, the Present State of the Art," with special reference to the development of Boston as an air port. The program will include papers on "Commercial Aviation in Europe," "The Development of Heavier-Than-Air Machines" and "The Development of Lighter-Than-Air Machines."

### PERSONALS

Wolman, Abel, has been elected chief engineer of the Maryland State Department of Health to succeed Robert B. Morse, resigned. He will continue as lecturer in sanitary engineering in the Johns Hopkins University School of Hygiene and Public Health, and as editor of the journal of the American Water Works Association.

Duff, Edward E., Jr., has been elected secretary of the National Paving Brick Manufacturers' Association to succeed M. B. Greenough. He is at present District Engineer of the Eastern Paving Brick Manufacturers' Association.

Fuller, Weston E., has withdrawn from the firm of Hazen, Whipple & Fuller, of which he has been a member since 1908, to become Professor of Civil Engineering at Swarthmore College. He will continue practice in civil engineering.

Kinnally, R. W., formerly resident engineer of the South Dakota Highway Commission, has resigned and joined the contracting firm of W. J. Cole at Huron, South Dakota.

Warner, B. L., formerly resident engineer for the South Dakota Highway Commission, has resigned and now occupies a similar position with the Illinois Highway Commission.

Gatchell, O. W., formerly assistant engineer with the Ohio State Highway Department, is now with Frank T. Miller, consulting engineer, of Greensboro, North Carolina.

Myers, Ray Z., formerly assistant engineer of Licking County, Ohio, has been appointed assistant division engineer of the Ohio Highway Department.

Russell, H. W., formerly senior civil engineer with the Interstate Commerce Commission, is now with the Department of Tests of the Illinois Division of Highways.

Buhrmeister, F. W., formerly junior highway engineer with the Illinois Division of Highways, is now with the American Bridge Company as detailer.

Bennett, J. G., until recently city manager of Ft. Myers, Fla., is now with the Wisconsin Highway Commission in the Bridge Designing Department.

Schrader, F. H., formerly resident engineer of the South Dakota Highway Commission, has been promoted to the position of district engineer, located at Brookings.

Pimm, A. B., county engineer of Hillsboro County, Florida, has been appointed by the county commissioners as engineer in charge of the construction work under the three million dollar bond issue.

Camp, Thos. R., recently city engineer of Breckenridge, Texas, has joined the firm of Hawley & Sands, consulting engineers located at Ft. Worth and Houston.

Allee, C. R., has recently been employed by the Port Jervis (N. J.) Waterworks.

Bryson, T. B., construction engineer associated with Holbrook, Cabot & Rollins, contractors of New York, died suddenly at his home September 5.

Costello, D. L., has been appointed resident engineer with the Massachusetts Bureau of Highways, stationed at South Egremont.

Bowlus, George F., formerly assistant engineer on dock construction at Superior, Wis., for the Great Northern, has recently joined the ranks of the Minnesota State Highway Commission, and will be located on construction work at Elgin, Minn.

Morgan, R. D., formerly city engineer of Temple, Tex., has recently resigned and been appointed superintendent of water and sewers at Mexia, Texas.

Webb, T. H., has been appointed assistant state highway engineer of Texas.

Bennett, Boyd A., recently director of public works of Lynchburg, Va., on September 1, became city manager of Charlottesville, N. C.

Cottrell, E. H., has been appointed city engineer of McKinney, Tex.

Schultz, Chas., recently city engineer of McKinney, Tex., has been appointed city engineer of Tulsa, Okla.

### PAMPHLET NOTES

"Recommendations on Future Policy in Stream Pollution Investigation Work." Article in Public Health Reports for August 25, giving recommendations of Messrs. Forbes, Jordan & Pearse as to the work which can be performed most profitably by the U. S. Public Health Service in carrying out its stream pollution investigation work.

"Use of Semi-Log Paper in Plotting Death Rates." Article in Public Health Reports for August 18 by Professor George C. Whipple in which he sets forth and illustrates by a number of examples the advantages of using semi-logarithmic paper for plotting death rates and studying changes in their general tendencies.

Reports on water works of Council Bluffs, Ia., and Omaha, Neb., together with fire departments, Structural conditions and hazards, as prepared by National Board of Fire Underwriters.

"Composition and Characteristics of the Population by States." Vol. III of

the Fourteenth Census, giving the figures taken in 1920. This classifies the population of each state according to color or race, nativity, parentage, sex, age, illiteracy; also gives school attendance, and combinations and group classifications of these figures. Most of these are given for 1910 as well as 1920, and classified as urban and rural.

"Annual Report of the Dept. of Public Utilities of Massachusetts." This report for the year ended Nov. 30, 1921, is published in two parts: Part I, of 272 pages, giving the report text, and Part II, of 506 pages, giving the returns, mostly in tabulated form, of the several gas, electric and water companies and municipal plants. These annual reports are of great value to all students of these classes of public utilities.

"State Investigation of Public Water Supply of Delaware, Ohio." This report is published as part of the August 11 issue of Public Health Reports by the U. S. Public Health Service. It gives, in fifteen pages, the report of F. H. Waring, principal assistant engineer of the Ohio State Department of Health.

"Ohio Law for Enforcing Correction of Stream Pollution and Improvement of Public Water Supplies." This law, with the latest amendments thereto, is published in full by the U. S. Public Health Service in Public Health Reports for August 11.

"Proceedings of the American Society for Municipal Improvements." Papers and discussions, and business transactions of the society at the convention of October, 1921. Includes four papers on street lighting, three on water works, seven on sewerage, fifteen on paving and paving materials and three reports on paving specifications, and eighteen others on conduits, markets, public comfort stations, city planning, snow removal and other topics.

"Special Assessments." A report of the Committee on Sources of Revenue of the National Municipal League, discussing and citing instances of the principles and practices as to special assessment administration. Special number of "National Municipal Review," a publication of the National Municipal League.

"Source of Lead Contamination of Cistern Water" a paper in Public Health Reports by Leonard Greenburg, assistant sanitary engineer. This article, published in the July 28 issue, is the report of an examination of the drinking water supply system at the U. S. Fish Hatchery station, Ten Pound Island, Gloucester, Mass., for possible sources of lead contamination. These reports, issued weekly, contain data concerning the prevalence of disease in the United States and foreign countries, the deaths during the third week before issuance, and articles on health matters. About 40 pages. Can be obtained from "Surgeon General," U. S. Public Health Service, Washington, D. C.

# New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

## ARCHER-FORD PAVING MIXER

A machine with the above name has been placed on the market by the Archer Iron Works with a view to use on small trucks for road paving and alley work. The mixer is mounted complete on a Ford truck chassis and sells at nearly half the price of other mixers of equal capacity. It is equipped with a side loader, automatic water tank and paving chute with two gate openings. The mixer frame is

## POWER-LIFT ROAD-RAZER

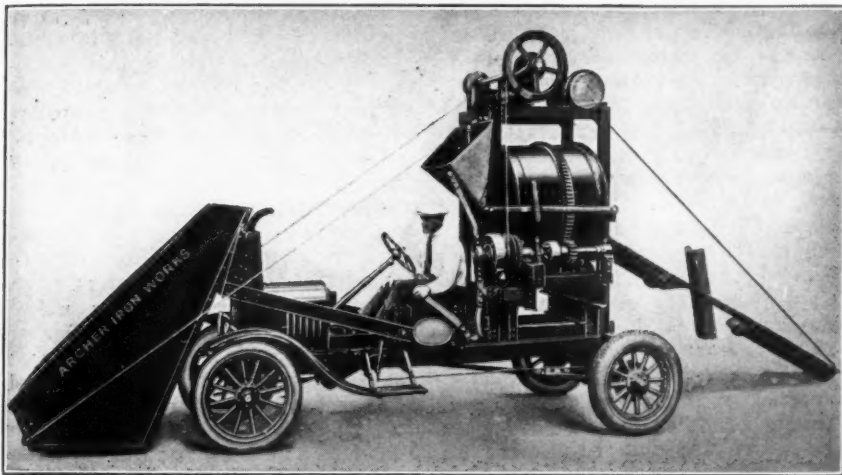
A new model of the original "Road-Razer" manufactured by the Avery Company has recently been placed upon the market. It differs from the original model in that it has a power-lift device connected with the motor and transmission which enables the operator to raise or lower the blades instantly by merely tripping a lever. The angularity of the blades is changeable. All gears are entirely

friction brake on this wheel. It has a comfortable cushion seat and backrest for the operator, and a twenty-gallon fuel tank with a hood separate. It is equipped with an improved type of muffler, a handy tool box, draw-bar attachment for pulling wagons, cement mixers, etc.

The motor is a powerful six cylinder, with 3-speed selective sliding transmission. It is equipped with a centrifugal governor of the throttling type which is entirely enclosed and runs in a spray of oil. The transmission is of the selective sliding gear type and all gears in the transmission case are of chrome-nickel steel, heat-treated and hardened. The 3-speeds are 1-3/4, 2-1/2 and 4-1/2 miles per hour, with 1-1/2 on the reverse.

## CHLORINE GAS PRODUCER

The Williams Electrolytic Cell, manufactured by the Electrolytic Chlorine Company, is used for producing chlorine gas by electrolysis of sodium chloride solutions. This method of producing chlorine gas has been used in the flour milling industry for several years with success and is now offered to superintendents of water works for manufacturing chlorine gas for sterilizing water. The gas being neither under pressure nor stored,

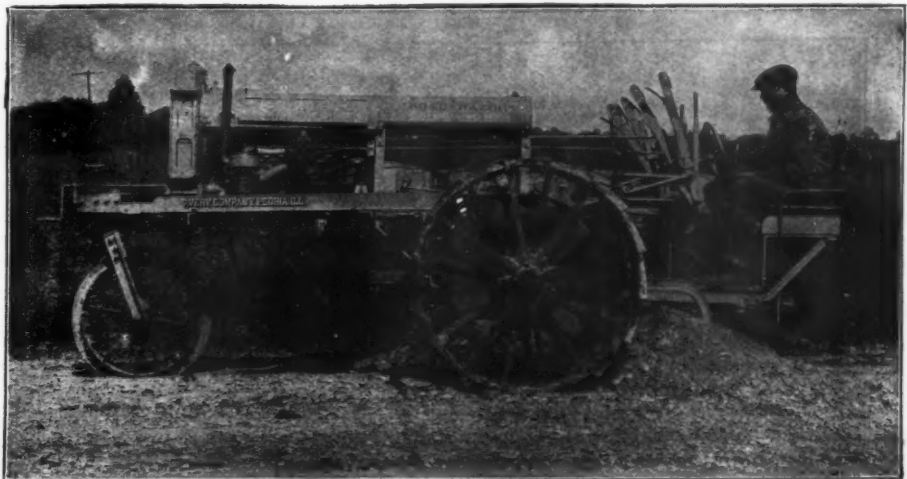


ARCHER-FORD PAVING MIXER.

clamped to the chassis with U-bolts and can be applied to Ford trucks already in service. The weight of the mixer complete with loader is approximately 2,500 pounds. This mixer is also furnished as a low charging mixer, the mixer drum being set directly on the truck chassis, and is equipped with a loading platform for charging the materials into the drum direct with wheelbarrows. This low charging mixer is not provided with the side loader, water tank or paving chute.

The machine is controlled by one man, has a capacity of 7 cubic feet of mixed concrete a minute and has a short wheel base. It can be operated from the driver's seat or from the ground. The mixing drum is the standard Archer 7-S one-bag mixer. The lifting arms of the side loader permit the dry materials to be held at the mouth of the loading hopper and discharged into the drum in 10 seconds.

The mixer is operated by the engine of the Ford, the power being taken direct from the front of the engine by a chain and sprocket arrangement.



AVERY ROAD-RAZER, NEW MODEL

enclosed and run in oil. The new machine is roller and ball-bearing equipped throughout, having an improved ball-bearing turntable on the front wheel with two sets of solid steel balls running in oil. It has a removable flange on the front wheel, also a

there is no danger from leaky valves and there are no tanks to bother with.

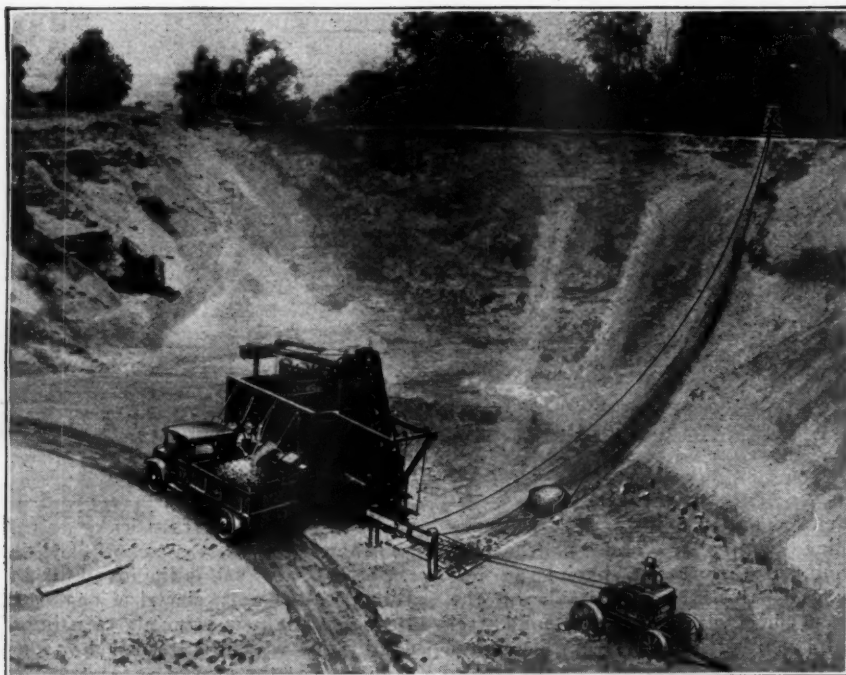
The Williams cell is the invention of John M. Williams, electrical engineer. It adopts the new principle of using a diaphragm which is placed horizontally so that the caustic soda stratifies



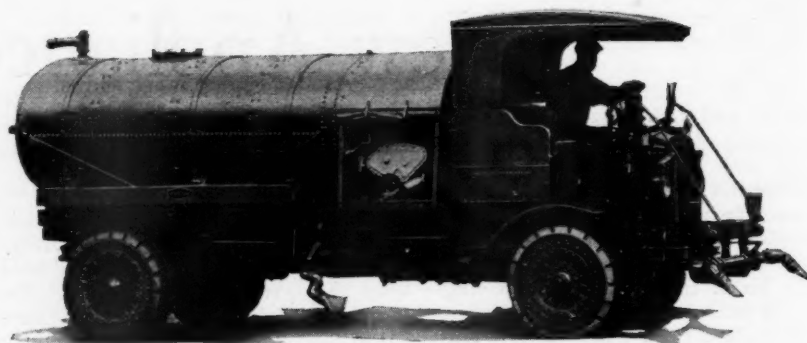
in the region of the cathode. An increase in the brine feed will cause a downward movement of this stratum and a fraction of an inch space between the anode and the caustic stratum will quickly restore the operation of the cell to its full chlorine efficiency. In the normal operation of the cell, the caustic is washed out as it is formed and contact of it with the chlorine is absolutely prevented.

In using the apparatus, salt is supplied to the saturator tube and water leaches through it, forming a strong brine which flows by gravity to the cell. When the cell is full of brine the starting switch is thrown in and current flows through the brine, creating the chlorine gas, which is drawn from the cell by means of a hard rubber ejector and forced directly into the main flow.

The amount of current required is 15 amperes each 24 hours for each pound of chlorine required. Power may be derived from belt-driven generators or a motor or a turbo-generator set. The materials used in the plant are pottery, iron enameled with heavy blue vitreous enamel, and reinforced concrete, none of which are oxidized by the chlorine. An asbestos sheet forms the diaphragm, and is renewed at intervals of six weeks or more, the change being effected in fifteen or twenty minutes. A plant capable of producing 33½ lbs. of chlorine per day occupies a floor space of 4 feet 8½ inches by 7 feet 3 inches. The cost of production of chlorine may be calculated from the units of 3 lbs. of salt and 1.8 k. w. h. per lb. of chlorine produced.



SAUERMAN PORTABLE POWER SCRAPER WORKING A GRAVEL PIT.



ENGINE SIDE OF AUTOCAR COMBINATION FLUSHER AND SPRINKLER.

#### PORTABLE POWER SCRAPERS

Sauerman Brothers have placed on the market a power scraper outfit that is readily portable and modest in price for use in handling materials in a comparatively small way, such as for stripping, excavating gravel pits, cleaning ponds and ditches, or any scraper service. The manufacturers say that less than an hour after reaching a location it can be set up and placed in operation. Only one man is used in running the outfit. The truck is built of heavy steel channels, has a fifth wheel in front, and is equipped with a tongue for either tractor or team drawing. A double-drum hoist is furnished, either with a gasoline engine mounted on it and directly connected, or it may be driven from a tractor or other motive power by belt. There are only two levers to handle. The operating cables and blocks are of the manufacturers' own design and Sauerman "Crescent" type of power scraper buckets are used.

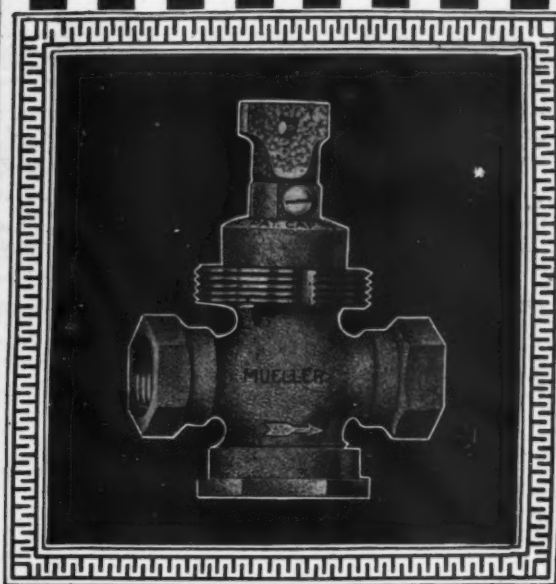
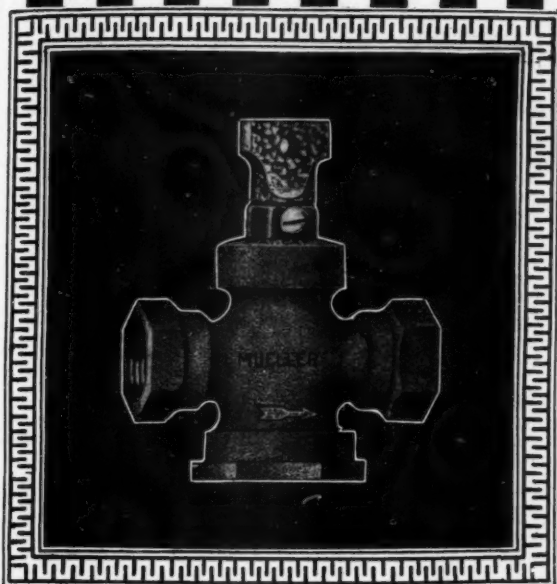
A bridle cable is stretched across the back end of the pit between two stakes or deadmen and the tail block is anchored to this by means of a bridle hitch frame and tail guy cable. The line of operation is then easily shifted by moving the bridle frame along the bridle cable. In order to set up the plant at a new location, chock the wheels of the hoist, connect bridle cable to new stakes or deadmen, locate guide blocks, haul out the cables, hook on to bucket, turn over the engine, begin operating.

There are two regular sizes, each either provided with gasoline engine or arranged for belt driving. One of these is rated as 8 h.p., the other as 15; the former with 1/3-cubic yard scraper bucket and the latter with 1/2-cubic yard. In the smaller plant the load cable is 3/8" and in the latter 1/2". The average capacity of the former is given as 15 to 20 cubic yards per hour and of the latter 20 to 30 cubic yards. In each the length of span is 200 feet and the blocks are 12" diameter.

#### AUTOCAR STREET FLUSHER AND SPRINKLER

The Autocar Company has recently furnished to the District of Columbia a new two-unit combination street flusher and sprinkler, which is mounted on a chassis with 156" wheel base and four to six tons capacity. Part of the special equipment of this truck is an extra 4-cylinder Autocar engine, which is used solely to drive a centrifugal pump discharging 350 gallons of water a minute at a 35-lb. pressure, the controls for this engine being located in the inside of the cab, convenient to the driver.

There are four flush nozzles, two at the front and two in front of the rear wheels. Each is controlled by an independent lever, and each is adjustable to any angle. There are also two slotted sprinkler heads in the front. The tank is oval in shape, of 3/16" riveted steel and has a capacity of 1,000 gallons. It is equipped with an 18" manhole, an overflow pipe, a trough board at each side, a cleanout plug, and has a water indicator on the rear.



## Why Mueller Brass Goods Excel and Outsell

For over sixty years **MUELLER** has always made goods to meet a need—never to meet a price! Today, **MUELLER** quality is unrivaled; **MUELLER** reliability is unquestioned; **MUELLER** leadership is undisputed.

## **MUELLER** Curb Cocks and **MUELLER** Corporation Cocks

are used by most Water Works Companies because they carry the lowest known up-keep cost. While they are built to last, they are also built to last a lifetime—and they do it! E-551, E-557, above, and E-101 and patented E-102, below, are widely used patterns.

The **MUELLER** Thread shown below gives a valuable margin of safety to Mueller Corporation Cocks by insuring a perfect joint and preventing breakage. Be sure to specify **MUELLER** Thread on all corporation cock orders.

**H. MUELLER MFG. COMPANY, DECATUR, ILLINOIS**

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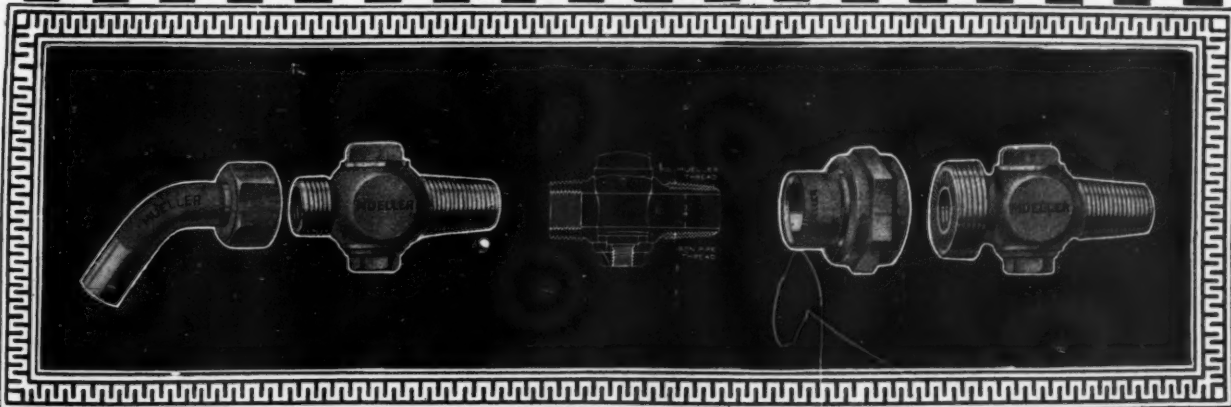
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## INDUSTRIAL NOTES

### HILL AND FERGUSON

The firm of Hill & Ferguson, consulting engineers, has been dissolved, taking effect on August 31, and the practice of the firm will be carried on by Nicholas S. Hill, Jr., at the same address and with the same office staff.

### FAY, SPOFFORD & THORNDYKE

This firm of consulting engineers has recently announced that it has admitted to partnership John Ayer, Bion A. Bowman, Carroll A. Farwell, Ralph W. Horne, Ralph T. Jackson, George L. Mirick, Barzillai A. Rich and Warren D. Trask, who have long been associated with the firm. The business of the firm will be continued under the same name as before.

### HAZEN, WHIPPLE & FULLER

This firm announces that Weston E. Fuller has withdrawn his membership from the firm to become Professor of Civil Engineering in Swarthmore College, and the firm has been changed accordingly, and again becomes Hazel & Whipple. All the other partners remain.

**STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, etc., required by the Act of Congress of August 24, 1912, of Public Works, published monthly at New York, N. Y., for October, 1922.**

State of New York, County of Queens, ss.: Before me, a Notary Public in and for the State and county aforesaid, personally appeared James T. Morris, who, having been duly sworn according to law, deposes and says that he is the business manager of Public Works, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and, if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor and business editor and business managers are:

Publisher—Public Works Journal Corporation, 243 West 39th street, New York, N. Y.

Editor—A. Prescott Folwell, Montclair, N. J. Managing Editor—A. Prescott Folwell, Montclair, N. J.

Business Manager—James T. Morris, White Plains, N. Y.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent. or more of the total amount of stock.)

Public Works Journal Corporation, 243 West 39th street, New York, N. Y.

Sumner W. Hume, 243 West 39th street, New York, N. Y.

James T. Morris, White Plains, N. Y.

A. Prescott Folwell, Montclair, N. J.

Contracting Pub. Co., New York, N. Y.

Stockholders of Contracting Publishing Co.:

H. F. Pomeroy, Forest Hills, N. Y.

J. R. Breuchaud, 290 Broadway, N. Y. City.

Frank W. Skinner, 243 West 39th St., N. Y. City.

H. F. Hackedorn, Consumers Bldg., Chicago, Ill.

3. That the known bondholders, mortgagees and other security holders owning or holding 1 per cent. or more of total amount of bonds, mortgages or other securities are:

Sweetland Publishing Company, 239 West 39th street, New York, N. Y.

4. That the two paragraphs next above, giving the names of the owners, stockholders and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting is given; also that the said two paragraphs contain statements embracing affiant's knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association or corporation has any interest, direct or indirect, in the said stock, bonds or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is: (This information is required from daily publications only.)

JAMES T. MORRIS, Business Manager.

Sworn to and subscribed before me this 2nd day of October, 1922.

(Seal)

E. P. MURRAY,

Notary Public, Queens County No. 3115. (My Commission expires March 30, 1924.)



## Adjustable Drawing Table

The SPHINX is an adjustable drawing table of simple and sturdy construction. Designed especially for the convenience of the draftsman, the table has a foot rest and a box for drawing instruments. The perfect balance enables it to stand firmly.

The SPHINX is constructed of selected ash, the board of well-seasoned white bass-wood.

### F. WEBER CO.

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## A Matter of Economy

### The MARTINIQUE

IS GLAD TO ANNOUNCE  
REDUCED RATES

SOMEONE must take the initiative in making it possible for people to travel and spend less money—now that there is less money to spend.

So, hand in hand with Hotel McAlpin, which recently announced its reductions, the Martinique—just across the street and under the same management—becomes a leader in lowering hotel tariff.

This is setting an advance style, as it were, for there has not been an appreciable reduction in the cost of running a large New York hotel.

However, the public esteems the spirit in which it is done, as much as the management of the McAlpin and Martinique appreciates its patronage, then indeed, is it worth doing.

At the Martinique the new prices are: \$3.50 up for room and bath; \$2.50 for room without bath.

### The MARTINIQUE

Broadway, at 32nd St., New York  
Frank E. Jago, Resident Manager

## CUMMER PORTABLE ROAD ASPHALT PLANTS (3 UNITS)

750, 1,250 and 1,800 Yards 2-Inch Sheet Asphalt Daily or Other Standard Mixtures.

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CUMMER PLANTS NEVER WAIT FOR HOT SAND

OVER 200 IN OPERATION

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Full Line Cumber Plants in London Stock.

# How's This For a Test?

A meter that can be frozen like the one illustrated here, without damaging in the least, certainly warrants your inspection.



The top and bottom casings and internal parts are secured together by means of bevel, square-headed brass cap bolts with slitted brass collars below the bolt heads. These slitted collars under excessive pressure, as occurs when a meter is frozen, will open, thereby leaving the top and bottom casings, as also the disc chamber and gear train free to part to any necessary amount, thus saving the casings and internal mechanism from any deformation. After freezing, the slitted collars can be reclosed and the meter bolted anew. This operation can be repeated without the necessity of furnishing any new parts.

We also make meters of every type for every requirement.

*Catalogue for the asking*

**THOMSON METER COMPANY**

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# LAMBERT FROST-PROOF METERS



## New Catalogs of Interest to City and County Engineers, Superintendents of Water Works, Superintendents of Streets, Contractors and All Engaged in Public Works

If you want any of these Catalogs, write the number on a postal, sign your name and address plainly, and mail it to PUBLIC WORKS, 243 West 39th Street, New York. The Catalogs will be sent to you promptly without charge or obligation.

### STORM SEWERS PREVENT FLOODED STREETS

468. W. S. Dickey Clay Mfg. Co., Kansas City, Mo. Book showing results on streets of the absence of storm sewers and containing tables for computing sewer sizes, rain fall charts, etc.

### PROTECTION FOR BUYERS OF PINE

469. The official report of the annual meeting of the Southern Pine Association held in March, 1922, was published under the above title and contains 264 pages of papers, lists of officers and members, etc. These papers deal with economic conditions in the industry, trade ethics, merchandising of lumber, forestry, grades of lumber, etc.

### PYROMETERS

470. Thwing Instrument Co., 3339 Lancaster avenue, Philadelphia, Pa., 8x10½ inches; 16 pages, illustrated catalog of electrical instruments in indicating single or multiple recording types for measuring all temperatures, from the coldest (liquid air) to the hottest (electric furnace).

### TEXAS ASPHALT MACADAM

471. Texas Company, 17 Battery Place, New York. A 12-page booklet briefly describing and illustrating the construction of asphalt macadam roads. Slightly revised from a similar booklet, reviewed in Public Works several months ago.

### IDEAL ENGINES AND EQUIPMENT

472. Ideal Engine Co., Lansing, Mich., catalog of 39 pages, 6x9 illustrating and describing gasoline engines in their several sizes and equipment for contractors and industrial plants—hoisting engines, diaphragm pumping outfits, force pumps and centrifugal pumps.

### PORTABLE POWER SCRAPERS

473. Sauerman Bros., Chicago, Ill. Circular describing portable outfit suitable for stripping, trenching, digging gravel pits, etc., 4 pages, 8½x11.

### TRINIDAD LAKE ASPHALT

474. The Barber Asphalt Co., Philadelphia, Pa. "The Last Analysis" tells of the durability record and low maintenance costs of pavements laid of lake asphalt during the past 48 years, 22 pages, 6x9.

### AUSTIN ROAD OILERS, SWEEPERS AND SPRINKLERS

475. The Austin Manufacturing Co., Chicago. Catalog describing pressure road oilers, heater attachment, trailer oilers, street sprinklers, street sweepers both horse-drawn and motor and other road equipment.

### SERVICE REPORTS ON MOTOR SWEEPERS

476. The Austin-Western Road Machinery Co. Letters from the Supts. of Street Cleaning of Jacksonville, Fla. and Detroit, Mich., and the City Manager of Niagara Falls, N. Y., telling of results in those cities of using Austin-Western sweepers.

### TREATING TANNERY SEWAGE

477. The Dorr Company, 101 Park avenue, New York City. Semi-technical description of problem and of its solution by Dorrco Screens and Dorr Clarifiers. A 12-page pamphlet, 7-1/2x10.

### AGITATION AND MIXING

478. The Dorr Company, 101 Park avenue, New York City. Description of the purposes and operation of the Dorr Agitator used for agitating pulp, ore and other solids carried in suspension in liquids. 24-page pamphlet, 7-1/2x10.

### TREATING SEWAGE AND INDUSTRIAL WASTES

479. The Dorr Company, 101 Park avenue, New York City. Describing the use of the Dorr Sewage Clarifier and Dorrco Screens for treating these materials. 8-page pamphlet, 7-1/2x10.

### VULCAN BUCKETS

480. Vulcan Iron Works, Jersey City, N. J. Catalogue of clamshell buckets, orange-peel buckets, dipper or scoop buckets, hydraulic dredging equipment and repair parts for each. 24-page pamphlet, 7-1/2x10.

### CURBING FOR MODERN STREETS

481. The Ohio Quarries Company, Cleveland, Ohio. Profusely illustrated catalogue, setting forth advantages of Buckeye Berea Natural Sandstone Curbing and describing method of manufacture. 18 pages, 8x10-1/2.

### STOCKLAND ROAD MACHINERY

482. Stockland Road Machinery Company, Minneapolis, Minn. Describes road graders, scarifiers, drags, dump wagons and Fresnoes, with methods of using the same in road

construction and maintenance. 36 pages, 8-1/2x10.

### FILTROS

483. The General Filtration Company, Inc., Rochester, N. Y. Describes Filtros material and its usage for filtration and as an air or gas diffusing medium in activated sludge plants, and methods for installing it. 32 pages, 6x9.

### MODERN FREIGHT TRANSPORTATION

484. The General Motors Truck Co., Pontiac, Mich. Describes the General Motors' Tractors and Trailers and many uses to which they have been put. 32 pages, 9x11-1/2.

### ARCHITECTS' SPECIFICATION HANDBOOK

485. The Truscon Laboratories, Detroit, Mich. A collection of specifications for use by architects covering waterproofings, damp-proofings, oil-proofings, floor-hardeners and protective finishers of various varieties, colors and materials. 52 pages, 8-1/2x10-1/2.

### RUN-OFF AND DISCHARGE DIAGRAMS

486. Clay Products Association, Chicago, Ill. Diagrams on logarithmic paper for calculating run-off from known areas and rates and for determining velocity and discharge for salt-glazed, vitrified pipe at different grades and velocities. 4 pages, 8-1/2x10-1/2.

### WATER PURIFICATION FOR SWIMMING POOLS

487. Everson Filter Company, Chicago, Ill. Describes equipment for filtering and sterilizing water from swimming pools, cleaning the walls of pools and heating the water. 6 pages, 9x12.

### THE ACTIVATED SLUDGE PROCESS

488. General Filtration Company, Rochester, N. Y. Description of activated sludge plants at Woodstock, Ontario and Gastonia, N. C., the latter a reprint from "PUBLIC WORKS." 16 pages, 6x9.

### TRENCH, TUNNEL AND PIPE WORK BY COMPRESSED AIR

489. The Ingersoll-Rand Company, New York City. Describes use of air tools adapted for contractors and public utilities, including clay diggers, pavement breakers, calkers, backfill rammers, installing service pipes, etc. 32 pages, 6x9.

# WATER METERS

FOR EVERY KIND OF SERVICE

Also Meters for Gas, Oil, Gasoline, Air and Other Fluids



Arctic



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GENERAL OFFICE AND WORKS, EAST PITTSBURGH, PA.

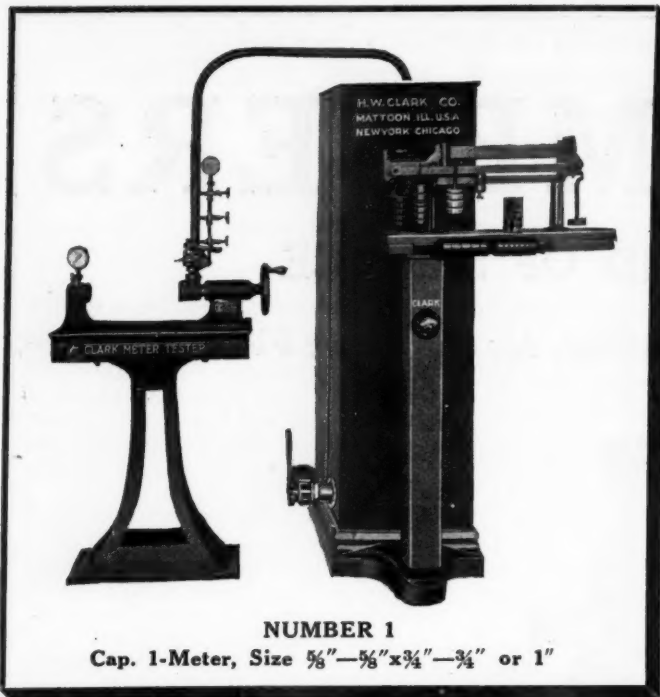
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*in use and developed  
throughout a period of  
thirty years of actual  
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Has many individual features—fractional flow valve; needle point sensibility valves (non-clogging); comparison pressure gauges; quick dial set feature; electric alarm; special scale with beam graduated in cubic feet, gallons and in pounds; 24% test beam. A size to fit your exact conditions. Low in price.

*Write for bulletin B and list of users*



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*Everything for the Water Works and Municipality*

1308 Broadway

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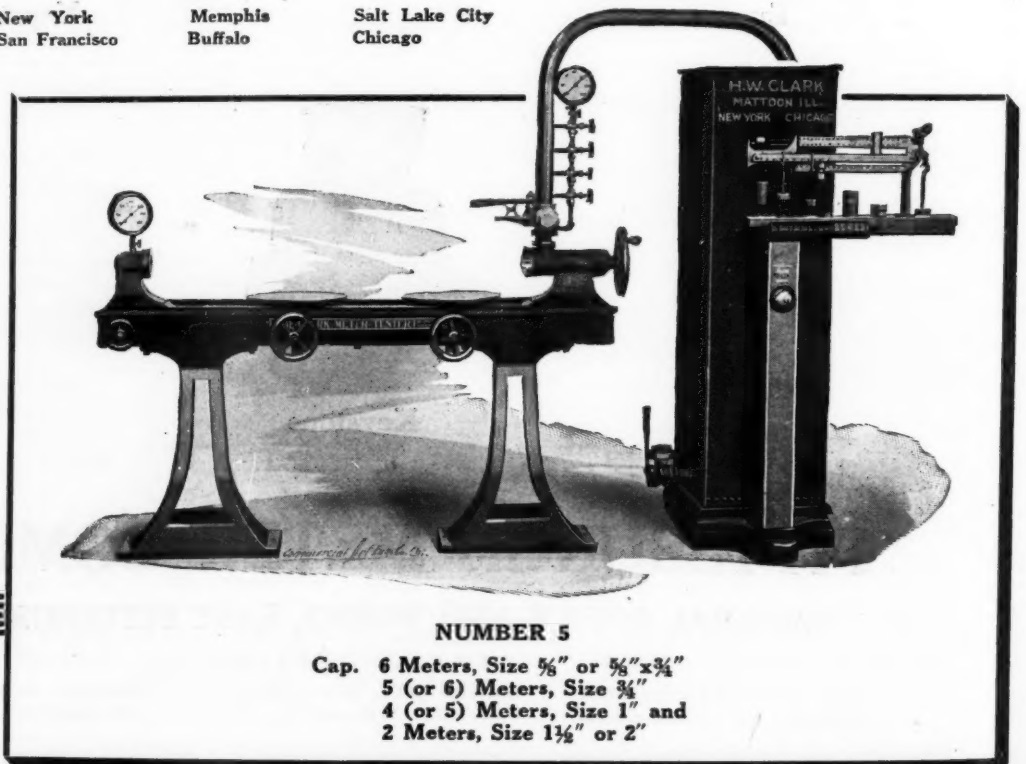
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Clark Meter Boxes—Southern  
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Venturi Meters—Check Your  
Pumpage and Waste—Bulle-  
tin G.  
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FIRE HYDRANTS AND  
VALVES, AIR VALVES,  
BRASS GOODS, etc.—  
Bulletin H.



# LOCK-BAR

Before Closing  
**STRONG AS THE PLATE ITSELF**

*Not made  
simply to  
sell—but  
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Lock-Bar Steel Pipe will carry approximately 43% greater working pressure than double riveted steel pipe. The longitudinal joint of Lock-Bar is 100% efficient.

On account of the smooth interior of Lock-Bar (absence of rivets, except at circumferential joints thirty feet apart), Lock-Bar is given a preference of 3 inch in diameter over riveted pipe for same carrying capacity.

For like capacity and like pressures Lock-Bar has the advantage of saving in metal on account of smaller diameter and thinner plate. The saving increasing with the diameters and pressures.

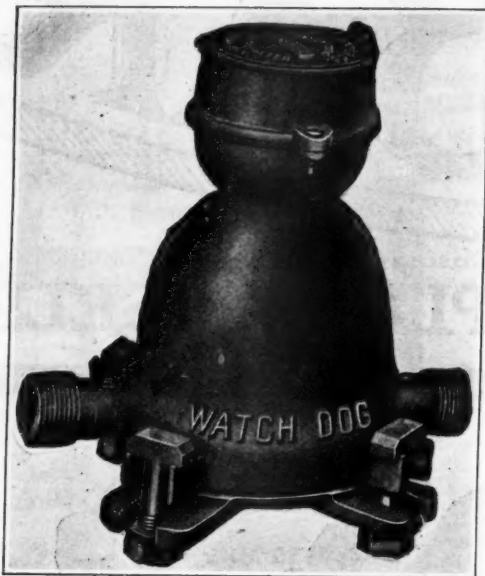


Executives write for "Handbook on Pipe"

## EAST JERSEY PIPE COMPANY

7 DEY STREET

NEW YORK



**ACCURATE DURABLE  
DEPENDABLE**

## **“WATCH DOG” FROST PROOF METERS**

*effect an enormous saving  
in labor and repairs*

The Frost Proof Meter may be had in all sizes up to and including 1¼".

The frost plate or bottom cap is brass lined as an added protection to the working parts.

The cap is designed to break when subjected to undue strain. When this fracture occurs, only the plate is damaged, the measuring unit being saved from distortion by the play afforded by the loosened plate. Replacement is easy—the cap is removed, a new one is replaced, and all that remains to be done is to pull up the bolts.

A hammer is unnecessary; no blows are required.

Waterworks officials and superintendents will find our catalogue of special interest.



**GAMON METER COMPANY,**



280-294 SOUTH STREET

NEWARK, N. J.

## *Chemicals for Water Purification*

We manufacture the highest grades of

**Sulphate of Alumina**

also

**Chloride of Lime**

and

**Liquid Chlorine**

**Pennsylvania Salt Manufacturing Company**

WIDENER BLDG.

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NATIONAL Pipe is Made Right—On New  
Equipment—By Use of Special Cores.

NATIONAL Pipe has Smoothest Inside  
Finish—Easiest to Work.

PROMPT SHIPMENTS

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SALES OFFICES:

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The total daily capacity of municipal  
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The Dry Feed machine illustrated is the most approved  
method of feeding chemicals in the science of water  
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The most perfect method of feeding chemicals in dry  
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SUCCESS

Send for bulletin 22-2

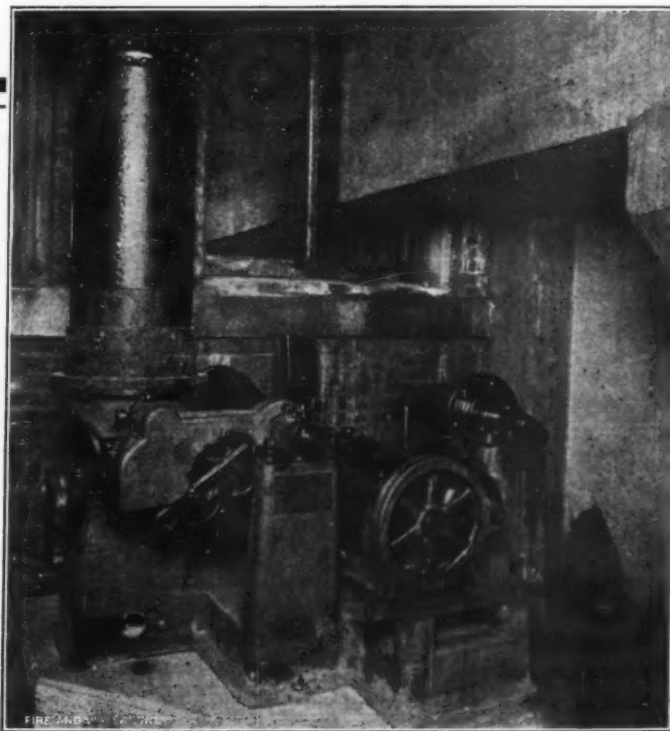
The New York Continental  
Jewell Filtration Company

Nutley, N. J.

New York

Chicago

Montreal



The ORIGINAL  
DRY FEED MACHINE



## RUST ONLY PROTECTS IT

In cast iron rust never penetrates below the surface; the first layer of oxide which it forms acts as a protection, effectively preventing further corrosion. Should the tar coating placed on all water pipe become destroyed, the metal will, in this way, form its own coating.

For this reason cast iron endures under exacting conditions. The history of cast iron pipe, and it goes back for centuries, has not been long enough to establish a limit.

Address Publicity Department, Burlington, for booklets on  
**Pipe for Water, Gas, Culverts, Fire Protection. Fittings, Standard or Special.  
 Municipal Castings to Engineers' Designs.**

### United States Cast Iron Pipe & Foundry Co.

General Office: Burlington, New Jersey

#### SALES OFFICES:

Philadelphia: 1421 Chestnut St.  
 Pittsburgh: Henry W. Oliver Bldg.  
 New York: 71 Broadway  
 San Francisco: Monadnock Bldg.

Chicago: 122 S. Michigan Blvd.  
 St. Louis: Security Bldg.  
 Birmingham: 1002 American Trust Bldg.  
 Dallas: Scollard Bldg.  
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**Sterling**  
 THE ENGINE OF REFINEMENT  
*For the  
 finest boats that float*

### vs. MAXIMUM DEMAND

Analyze your power costs—it will pay you to use STERLING engines. With a STERLING engine to carry peak loads you can purchase power at the minimum rate, run your STERLING when the peak comes on, and have an efficient standby unit, ready instantly. Based on the average difference between the central station minimum power rate and the charge for demand service, a STERLING driven pump or generator set would probably pay for itself within two years.

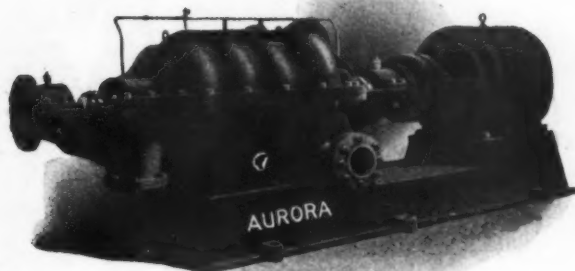


Model GRC 4 cylinder 150 H.P. STERLING direct connected to 6" 2 stage DeLaval centrifugal delivering 1050 G.P.M. against 260 ft. head at 1200 R.P.M. Reserve pump installed at Seneca Falls, N. Y., by Power Equipment Co., of Boston.

**STERLING ENGINE CO., Department C-5, BUFFALO, N. Y.**

40 to 300 H. P. at 1200 to 1500 R. P. M.

# AURORA PUMPS



*Embody all recent improvements made in pump designing*

We employ the best engineering talent obtainable. We stand squarely back of every pump we make—an interest in an installation lasts the life-time of the pump.

We welcome the opportunity to submit plans covering the manufacture of special equipment for your particular needs. We are proud of the achievements of an engineering department and confident of their ability to satisfy your requirements completely.

**THERE IS AN AURORA PUMP FOR EVERY NEED**

Consultation no obligation.

**AURORA PUMP & MANUFACTURING CO., AURORA, ILL.**

## Facts

*about*



The Badger Turbine Meter illustrated is designed to handle services where the demand is for large volumes of water with very little loss of line pressure. Everything has been done to provide the proper materials for Badger Meters to insure long life and accurate registration at a reasonable price. These materials, with excellence of workmanship, insure satisfaction to all users.

*Special bulletins on any type of Badger Meters sent free on request.*

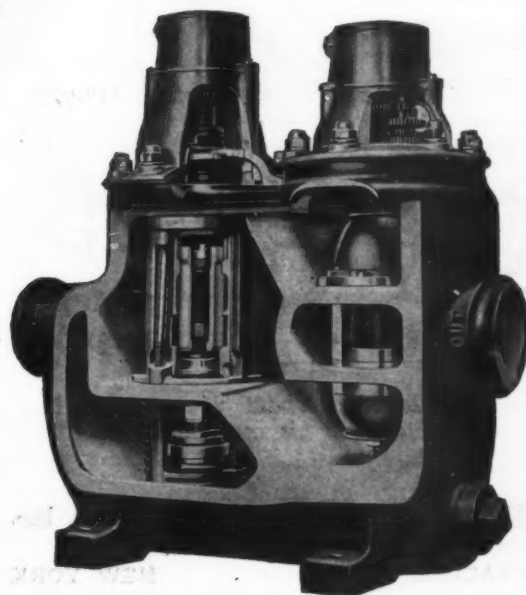
**BADGER METER MFG. COMPANY**

**FACTORY AT MILWAUKEE, WIS.**

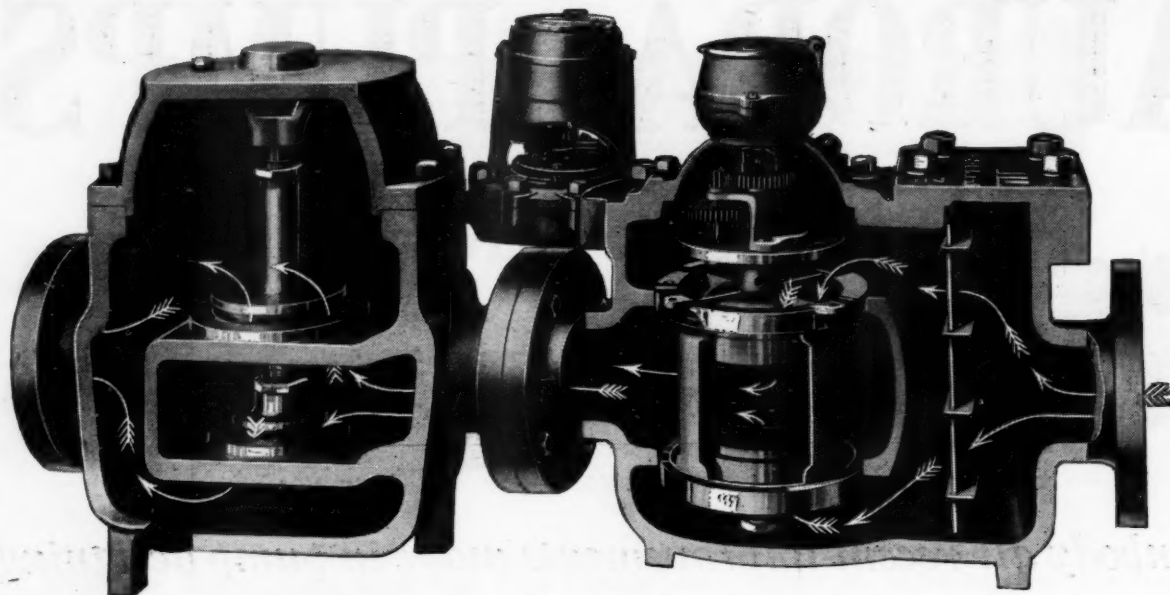
Sales and service offices:

CHICAGO, ILL. KANSAS CITY, MO. BROOKLYN, N. Y. DENVER, COLO.  
111 W. Washington St. 414 Interstate Bldg. 32 Court St. 1621-39 15th St.

All Badger Meters have the  
important characteristic of  
**LARGE CAPACITY**







## NILO COMPOUND METER

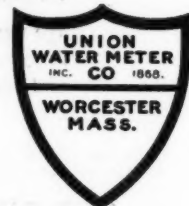
Consists of three separate and complete units which may be used individually, if desired. Working parts of Nilo Velocity Meters, King Disc Meters and Union Compounding Valves are each assembled in a single unit, readily accessible for inspection without disturbing pipe connections. Catalogue P-52.

*Makers of approved water works specialties since 1868.*

UNION WATER METER CO.

Incorporated  
1868

WORCESTER, MASS.



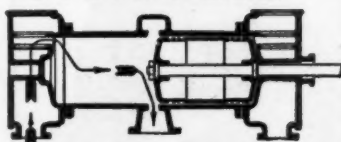
**You need  
this book**

on the  
**UNA-FLOW  
STEAM  
ENGINE**

*Second English Edition*

By  
*Prof. J. Stumpf*

**STUMPFLOW**



**DESIGN**

**\$5**

postage  
prepaid

*Write Now about your power  
problems to his own agent and  
engineers.*

**STUMPF UNA-FLOW ENGINE CO., Inc.**

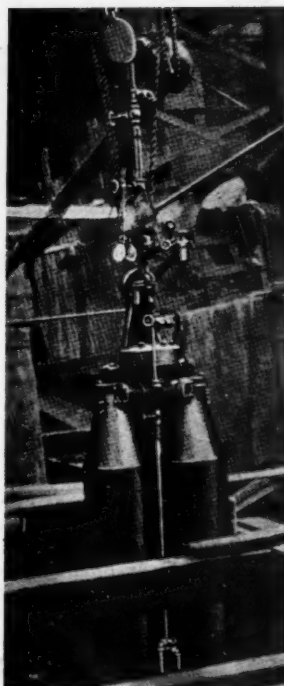
206 E. Genesee Street

SYRACUSE

NEW YORK

## EMERSON PUMPS

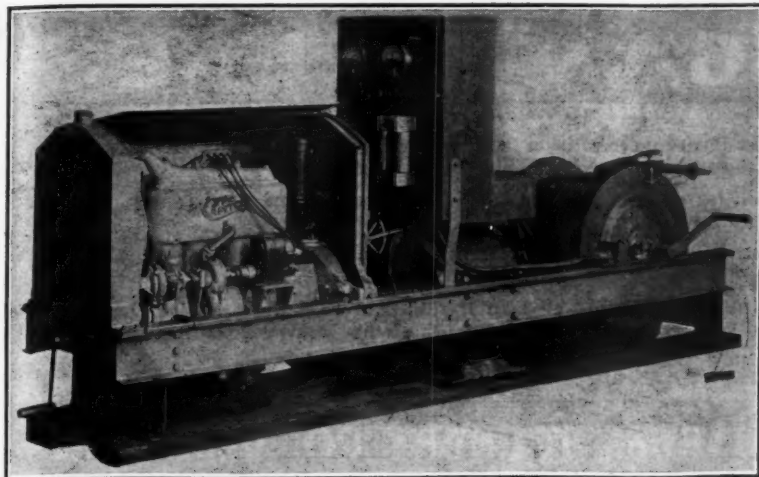
### ON EVERY CONTRACT



The Emerson Steam Vacuum Pump is practically indestructible, is entirely self-contained, and has no working parts exposed or in sight. No foundation is required. Outside belting, shafting, or engine; self-priming and so simple that skilled attention is unnecessary. Ability to handle solid matter and entrained air without stopping, permits their use on work where other pumps are hopelessly inadequate. They will operate in any position. Requires no exhaust pipe. Steam consumption is low. Takes but little space in shaft.

Catalogue on request.

**EMERSON PUMP and VALVE CO.**  
ALEXANDRIA, VA.



## **"CAPITOL"** GASO-ELECTRIC THAWING SET

### *for thawing frozen service underground pipe*

Equipped with a generator and its operating engine, and furnishes electricity to the reeled cable, one end of which is connected to the nearest fire hydrant and the other end to the generator and to the service pipe in the building, thus providing a complete circuit for the current, which is regulated to provide sufficient electric resistance in the service pipe to thaw it out in from 5 to 15 minutes—average 11 minutes per thaw.

Truck is ten feet long—equipped with 500 feet of cable.

Water Works officials and Engineers should investigate this apparatus before the severe weather sets in.

## **AUTO ENGINE WORKS**

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AND

### **FIRE HYDRANTS**



Smith Fire Hydrants are scientifically constructed by engineers to deliver the greatest volume of water under a given pressure. They are designed with easy-flow waterways without detours or obstructions which have a tendency to kill efficiency. Built strictly along hydraulic principles to meet the exacting demands of modern fire equipment. Built for rugged use. Adopted by many cities. Especially designed for high pressure service.

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### **VALVE INSERTING MACHINE**

With this machine you can insert new valves in existing lines under pressure, avoiding annoyance to consumers and also avoiding great fire risks. This machine will cut section of pipe, place required size valve in position, complete the work in every detail without interruption to supply. Insert all sizes 4" to 24" inclusive.

You can buy them or rent them.

Write for our proposition



Makers of Smith Tapping Machine, Valves, Lead Furnaces,  
Pipe Cutting Machines, Gate Valves and Other Water Works Specialties

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**THE A. P. SMITH CO., EAST ORANGE, N. J.**



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Michigan Valves and Fire Hydrants have been in constant use for many years throughout the United States and Canada and are giving universal satisfaction.

With our increased facilities and the installation of additional modern machinery, we will be able to assure you prompt service.

We solicit your inquiries and will be pleased to submit estimates and supply catalogues upon request.

We manufacture a full line of "Michigan" Fire Hydrants, Water Gates, Valve Boxes, Sleeves and Valves, Indicator Posts, Sluice Gates, Check Valves, Foot Valves, Water Works Supplies, Grey Iron Castings, etc.

**MICHIGAN VALVE and FOUNDRY CO. DETROIT, MICH.**



**It Carries More Water for Its Diameter Than Any Iron Pipe**

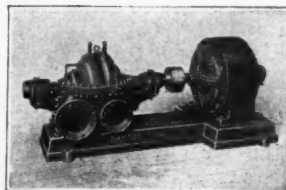
WYCKOFF WOOD PIPE is not impaired by the effects of electrolysis acid fumes or corrosion. It is light, strong and very durable. Lengths, 6 feet to 12 feet long. Size for size, it carries 14 per cent. more water than iron pipe. Costs less for transportation because it is lighter and easier to handle.

May we send Catalog giving fullest details?

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**SHEAR, FLAP, PLUG DRAIN  
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BUTTERFLY VALVES**

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STONINGTON, CONN.

Manufacturers of COMPRESSED AIR FIRE  
WHISTLES, WHISTLE BLOWERS, BELL  
STRIKERS, BOXES, GONGS, Etc., Etc.

Estimates Cheerfully Given

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**Inspecting Engineers**

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Pittsburgh, Pa.

### INSPECTION

Road building material of all kinds. Cast iron, steel riveted and lock bar pipe. Structural steel for Buildings and Bridges. Inspection Road Building Equipment, new and second-hand, Storage Tanks.

**HAVE YOUR MATERIALS INSPECTED  
AND TESTED—SAVE IN YOUR  
MAINTENANCE COST**

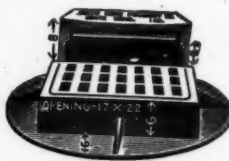
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## South Bend Foundry Co.

SOUTH BEND, INDIANA

Adjustable Curb Inlet

All Kinds of

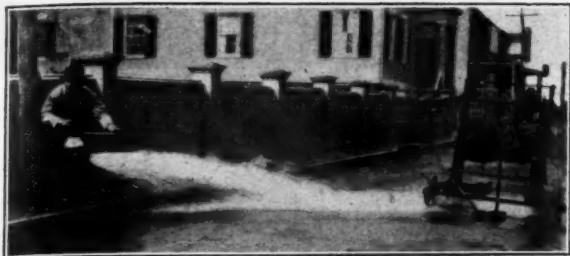


**Gray Iron Castings  
Patent Chilled  
Manhole Covers**

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AND PRICES

Made in 250, 300, 350 and 400,  
470, 490 lbs. Weights





## Clean Water Mains Deliver Full Capacity

If there is growth or deposit in your mains it will seriously affect the carrying capacity. It will cost a great deal less to send water through clean mains.

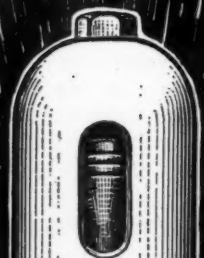
During the past 15 years we have cleaned mains in several hundred cities and the results in increased pressure and reduced operating costs have been thoroughly satisfactory.

We are glad to confer with municipal officials or water companies.

National Methods Are Patented

**National Water Main Cleaning Co.**  
54 Church St. New York

Liquid Chlorine



38740

Your order for a 100-lb. cylinder of CHLORINE will be executed with the same care and promptness as that of a larger quantity.

By the same token and by reason of our facilities, we are able to dispatch a tank car with that same precision and exactitude.

**Electro Bleaching Gas Co.**  
PIONEER MANUFACTURERS OF LIQUID CHLORINE

Plant: NIAGARA FALLS, N.Y.  
Main office: 21 East 41st Street, New York. Chicago office: 11 So. La Salle St.



## MATHEWS FIRE HYDRANTS

*The recognized  
standard  
for over  
50 years*

*Frost-Proof  
Positively Automatically Drained  
Always Dependable*

## GATE VALVES

FOR ALL PURPOSES

## CAST IRON PIPE

AND FITTINGS

## "REDUCED" FITTINGS

*Write for Catalog and Prices*

**R. D. WOOD & CO.**

Philadelphia, Pa.

## A REAL CUSHION TRUCK TIRE



Copyright 1922, by The Goodyear Tire & Rubber Co., Inc.

At the left is seen the famous All-Weather Tread and the Indented Sidewall of the new Goodyear Cushion Truck Tire. Right—a cross-section showing the Goodyear Patented Hollow-Center

Goodyear has produced a real cushion truck tire embodying both the original Goodyear Hollow-Center Cushion and the famous All-Weather Tread.

It unites in one tire the resilience of the cushion, the wearing quality of the solid, and the tractive power of the All-Weather Tread.

It is a development of the Standard Goodyear Hollow-Center Cushion Tire, more than 30,000 of which have been proved in actual service during the last five years, and it is a distinct advance on that splendid tire.

The Goodyear All-Weather Tread Cushion Tire has a pressed-on base that defies base-separation troubles.

Its tread is the powerfully tractive All-

Weather Tread design, insuring sustained headway under all road and weather conditions, saving fuel and engine strain by its sure gripping.

Its triple cushion design makes it a real shock absorber, resilient beyond any other tire excepting the pneumatic. It has the advantage of the patented hollow-center, the high, thick blocks of the All-Weather Tread, and a new sidewall pattern that permits easy compression under pressure.

The Goodyear All-Weather Tread Cushion Tire is made in all standard sizes, up to and including 7 inches, and is specified for all-round equipment on light and medium duty vehicles and as front wheel equipment with Goodyear All-Weather Tread Solids on the rear, for heavier trucks.

For further information, write the Government Sales Department at Goodyear, Akron, Ohio, or Los Angeles, California.

*In placing orders for new apparatus, you should definitely specify this Cushion, unless your needs are for Goodyear All-Weather Tread Solids or Goodyear Cord Truck Tires*

GOODYEAR



# Equipment

## Will Reduce Your Operating Costs

*Its reliability enables you to  
complete your contract  
on time*

Find out about the full line of Acme Road Building Machinery.

We manufacture: Acme Four-Cylinder Motor Road Roller; Rock Crushers—Solid Cast-Steel Frame Portable and Stationary; Elevators, Screens, Portable Storage Bins; Tom Thumb Graders, Patrol to Traction; Portable Gravel Screening and Unloading Plants; Wagons, etc., Steam Road Rollers.

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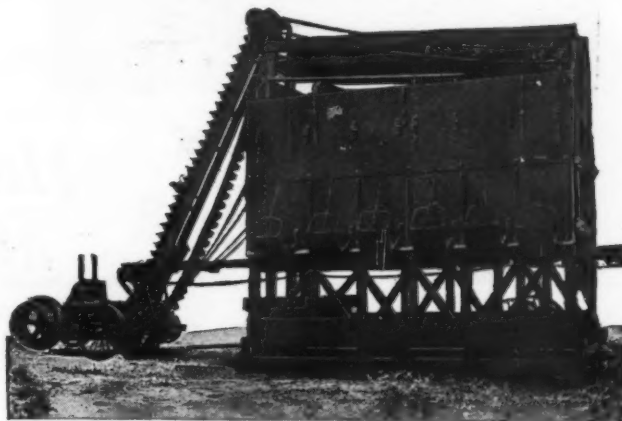
4 CYLINDER MOTOR ROLLER



ROAD GRADERS



BOTTOM DUMP WAGON



MTD. FULL PORTABLE CRUSHING AND SCREENING PLANT

# ACME ROAD MACHINERY CO.

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**Kinney**  
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## Road Planer

Especially designed for use on bituminous roads and highways. For planing or leveling the waves or ridgy elevations that frequently appear on the road surface; without destroying the contour of the surface. May also be used to good advantage on macadamized or dirt roads.



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## Patent Combination Auto Heater and Sprayer

For heating and applying under Pressure all varieties of Bituminous Materials, Hot or Cold, for Road construction, Maintenance or Dust Laying.

Heat and volume under instant control of operator. Positive pressure produced by the Kinney Pump.

When not required for road oiling the tank and entire oiling equipment can be removed, and the truck used for other purposes.

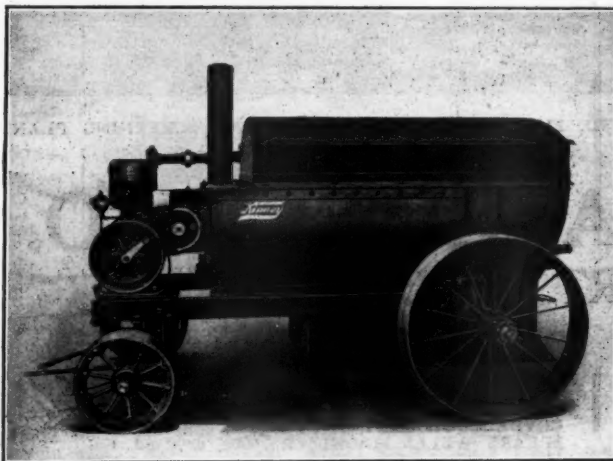


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## Handy Heater and Sprayer

ESPECIALLY ADAPTED FOR ROAD  
MAINTENANCE CONSTRUCTION  
AND GENERAL REPAIR WORK

Contents thoroughly agitated while heating. No burning or coking of material. Pump, Piping, Hose, Nozzles, Automatically Heated. No Steam Required.



## Kinney Manufacturing Co.

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Cuba



# —WIARD—

## ROAD OR CONTRACTOR'S PLOW

For tearing up cobblestones and macadam—it can be used as a perfect roter and pavement plow by simply removing the steel wing below the moldboard—thus making a TWO-In-One plow for all around work. Ordinarily, the contractor has one plow for general purpose or furrow work and another plow for roter work or tearing up old pavements. The Wiard does the work of both and answers any and all purposes—means a less investment and keeping in stock extra parts for one plow only.

### LIGHT AND STRONG

We make a full line of plows for every requirement.

*Write for descriptive literature.*

**Wiard Plow Co.,      Batavia, N. Y.**

### USED AS A ROOTER PLOW



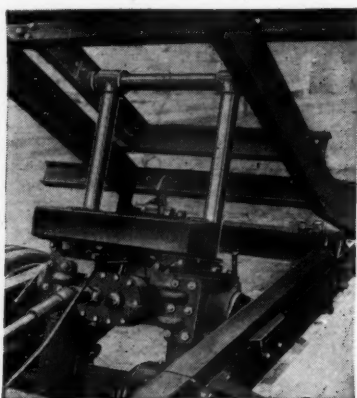
No. 69 (All Steel) Contractors' Plow, Landside View



Cushman-Wright Contracting Co., Chicago, Ill.

**"HYDRO HOISTS** require so little attention," writes Barney Cushman, of the Cushman Wright Contracting Company, Chicago. Hundreds of other contractors who are using Heil Dumping Equipment on their trucks have had the same experience.

"Not one cent for repairs, and I've dumped loads under conditions one would think impossible"—"Save more time and get better results with the Heil Hoist"—"Not one minute's trouble"—"An ideal unit for general dump truck work"—"Well satisfied"—"Can be depended on." These are a few opinions from fleet owners in California, New Jersey, Minnesota and Illinois.



Upper View—2 yd. 2 "Batch" Model SSC Dump Bodies and No. 4 Hydro Hoists on 2-ton Trucks. Dumping angle 54 degrees.

Lower View—Typical installation of Hydro Hoist on truck. Note its simplicity and compactness. There is no lost space with the Hydro Hoist.

Literature on Dump Bodies and Hoists for road building, construction work, asphalt, ash and garbage hauling, sent on request. Special folder on Bodies Equipment for Ford Trucks. Write today.

**THE HEIL CO.**

1132-50 Montana Ave., Milwaukee, Wis.

Sales and Service Stations  
New York, Chicago, St. Paul, San Francisco  
Pittsburg, Cleveland, Washington, Richmond



## CLEANING STREETS

BY

## VACUUM

Sucking the dirt from the streets, without dust or the necessity of sprinkling, is the way of the Ohio Municipal Equipment Vacuum Street Sweeper. It is noiseless in operation and maintains a speed of about 3 to 5 miles an hour.

## PROVEN BY MANY SEVERE TESTS

This Sweeper will clean all paved streets, not only those with surfaces perfectly smooth, but even cobblestones. It has stood the tests of experts.

*Write for details of tests  
and actual operating costs*

The  
**Ohio Municipal Equipment Co.**  
Columbus, Ohio



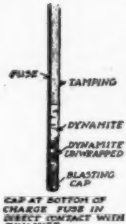
# Dynamite Efficiency Depends upon Proper Priming

Load Dynamite the *Wrong* Way  
and You Lose Money



Here is one  
**WRONG** way:

For instance, the cap with fuse should not be placed at the bottom of the hole like this as the side spit of the fuse would be likely to set fire to the dynamite.



—here is  
another

This is also bad practice as the cap is pointed away from the charge instead of toward it and the fuse is also likely to set fire to the dynamite before the cap explodes.



—and another

Even the middle of the charge is not the right place to put the primer as the top cartridge does not receive the full force of the cap and the fuse may ignite the powder that touches it.



—still another

Lacing the fuse through the priming cartridge is bad practice. It nearly always lets the fuse side spit into the dynamite.



Another  
**WRONG** way:

This kind of loading, without tamping, is expensive and inefficient as the top cartridge wastes most of its force blowing out the hole. The Bureau of Mines reports that tamping increases the effectiveness of high explosives enormously.



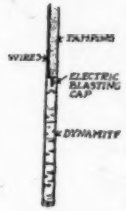
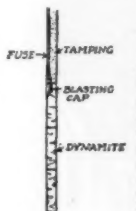
—and another

If the holes are full of water the cartridges of dynamite should not be slit as water affects nearly every kind of dynamite except gelatin.

Load Dynamite the *Right* Way  
and You Save Money

The  
**RIGHT** way:

This way, with the cap in the top of the top cartridge, pointing down toward the bulk of the charge, with lots of tamping and no part of the fuse touching the powder will give you a perfect shot every time.



Another  
**RIGHT** way:

Or even if you fire electrically, you will get best results this way as the electric blasting cap is placed so as to exert its maximum detonating effect on all the explosive in the charge.

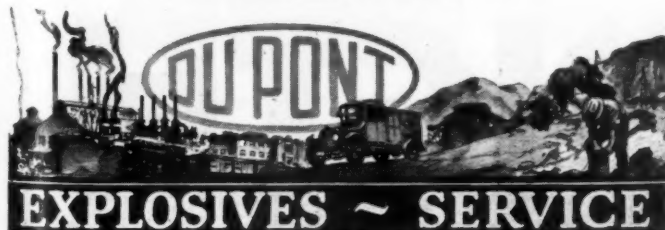
Birmingham, Ala. Duluth, Minn. Pittsburgh, Pa. Scranton, Pa.  
Boston, Mass. Huntington, W. Va. Portland, Ore. Seattle, Wash.  
Buffalo, N. Y. Kansas City, Mo. St. Louis, Mo. Spokane, Wash.  
Chicago, Ill. New York, N. Y. San Francisco, Calif. Springfield, Ill.  
Denver, Colo.

**E. I. du Pont de Nemours & Co., Inc.**

Explosives Department

Wilmington, Delaware

Du Pont Products Exhibit Atlantic City, N. J.



Gar Wood says:

"Wherever there is road-building, there is evidence of the superiority and popularity of Wood-Detroit Hydraulic Hoists and Steel Bodies."

*Gar Wood*

## Built by "Gar" Wood

In every country, in every state, almost in every county—you will find Wood-Detroit Dumping Equipment doing its work, dependably and economically.

For these better hoists and bodies far outnumber all other makes combined.

# WOOD

Hydraulic Hoists and Steel Bodies

Produced in the largest and finest plant in the world devoted exclusively to the building of hydraulic hoists and steel bodies, and built to the highest standards of material and workmanship, they represent a value that is beyond competition—the choice of over 90% of the truck makers.

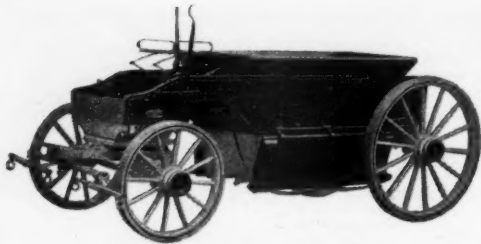
Be sure you specify Wood-Detroit Hydraulic Hoists and Steel Bodies.

**Wood Hydraulic Hoist & Body Co.**

7924 Riopelle Street

Detroit, Mich.

Sales and Service in All Principal Cities



SUSQUEHANNA MODEL  
From 1½ yards to 3 yards Capacity.

*We build the Jennings  
Automatic Dump body  
for Fordton and other  
makes of ton trucks.*

*Send for descriptive  
literature and prices.*

## AUTOMATIC DUMP WAGON for Contractors

### *Strong and well designed*

An exceptionally sturdy dump wagon. In closing the bottom doors, one side always shuts first, making a dirt-tight joint. Its light draft, large wheels and short turning radius make it unusually desirable for road work.

*The Columbia Wagon and Body Co.  
Columbia, Pa.*

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THE well-known strength of corrugated metal insures the purchaser of Newport Culverts that he is getting the maximum strength for supporting the overburden and traffic load. Made in full-round and half-round shapes to fit every condition. The moderate first cost is the only cost. They last a life-time. Full descriptive literature sent free on request.



**NEWPORT CULVERT CO., Incorporated**  
542 W. 10th Street  
Newport, Kentucky

100% QUALITY



# for **STRENGTH**



**O**UR more than thirty years' experience enables us to select materials and design equipment which will render the best service. The number of Buffalo-Springfield Rollers now in use is not equalled by that of any other make of roller produced in America or abroad.

Manufactured in all types and sizes, steam and motor. Get full particulars regarding them.

**The Buffalo-Springfield Roller Co.**  
Springfield, Ohio

## BUFFALO-SPRINGFIELD ROLLERS

## COLD PATCH



(1)  
Repairing Bituminous Concrete



(2)  
Same, two months later, showing repairs after being consolidated by travel

### HEADLEY No. 1

AN ASPHALTUM EMULSION

For repairs and resurfacing.

No expensive heating plant required.

Can be used in wet or dry weather.

No time lost account wet materials.

*Write for descriptive booklets.*

## ASPHALT AND ROAD OIL

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NON-LEAKABLE WELDED

"Held by the Weld"

### TAR AND ASPHALT HEATING KETTLES



Combination Heater and Dryer  
Equipped with Lid and Draw Valve

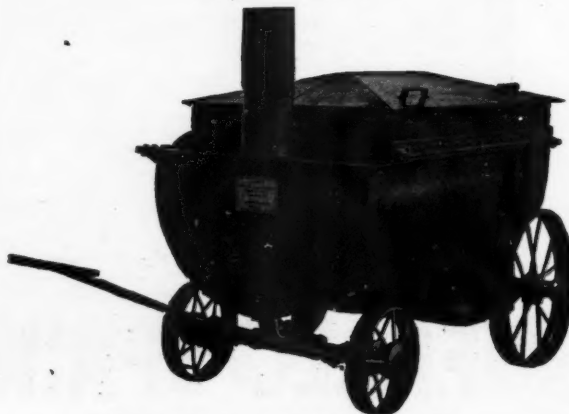
20 Styles—10 to 1,000 Gallon Capacity

Our most complete stock enables you to obtain any size and style of heater you require.

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CONNER & CO., Inc. 3900 North Second St.  
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Style "B"—300 to 500 Gallon Capacities



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REPUBLIC MIXERS are instantly available—stocks in **forty cities**—no long freight hauls—no delays—you get your mixer when you want it.

In addition to prompt delivery, you get a durable efficient mixer—an outfit that will **save** you money and **make** you money. Wire collect for name of your nearest Republic distributor.

Sizes 3½,  
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cu. ft.  
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Prices  
**\$195**  
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Get prices—save  
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Model above is  
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Standard Asphalt Binder A for surface treatment.

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Specifications and all  
other particulars furnished  
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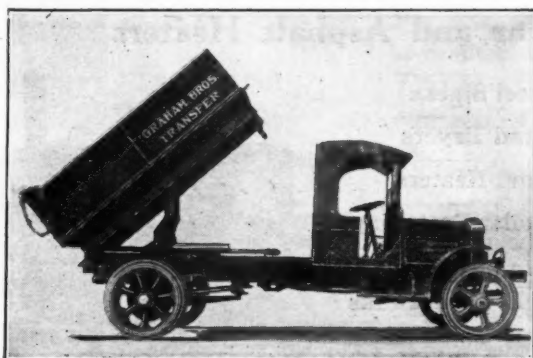
When the mighty guns on the Western front hurled broadsides of ponderous steel projectiles, the turrets and forts, regarded as impregnable, crumpled like cardboard. The result was a resort to earth trenches and embankments. Why? Because the only resistance possible was that of absorbing the shock instead of defying it. The same principle dictates shock absorbers and pneumatic tires for automobiles and trucks to protect the vehicle and its load. Our streets and roads must withstand the bombardment of more than four million truck wheels. The shock absorber in this case is the asphalt wearing course whatever the base. Asphalt—resilient, dustless, noiseless, waterproof, wearproof—the pavement of Broadway, Fifth Avenue, Michigan Boulevard, Broad Street, and Pennsylvania Avenue, is the last word in modern pavement design and is no more costly than a rigid, unprotected pavement.

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Type DS-2 Standard Body, with Under-Body Hoist  
Specially Designed for Heavy Road Work

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Quick, clean dumping depends largely upon the dumping angle. Standard DS-2 Type bodies, equipped with under-body hoists, give a greater dumping angle than any other equipment.

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All Repair Parts Carried in Stock at Kansas City

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The fact that you are using a high strength explosive does not necessarily mean that you are employing the **BEST** explosive for your work. Atlas Service Men frequently have found cases where a lower strength and **LESS COSTLY** grade was made to do certain work with **Greater Efficiency** than a higher strength explosive. Write us about studying the conditions affecting your work.

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Illustration shows N. P. B. M. Standard Rattler for testing of paving brick.  
**COMBINES ALL THE LATEST IMPROVEMENTS**  
 and requirements of construction

Thoroughly tested and tried out for a period of one year under the direction of the technical committee of the National Paving Brick Manufacturers' Association.

*Write for descriptive circular and prices.*

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By Using a  
**RELIANCE PORTABLE CAR UNLOADER**  
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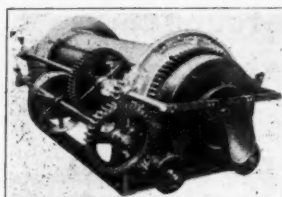
CAPACITY 25 TO 35 TONS AN HOUR

BEARS THE USUAL GENEROUS RELIANCE GUARANTEE  
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RELIANCE ROAD BUILDING-LABOR SAVING EQUIPMENT



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**Gravel, Sand  
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Rakes and scoops the material against a constant flow of water, which frees it from dirt, clay and other impurities. Easily moved from one job to another—it is portable. All parts are interchangeable. Washes ten or more tons per hour. Write for further information.

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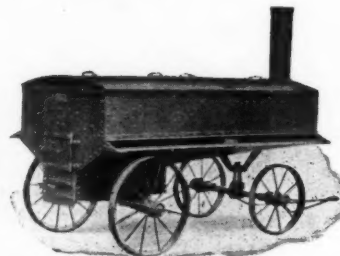
Sand Dryers

Tool Heaters

Boiler Breechings

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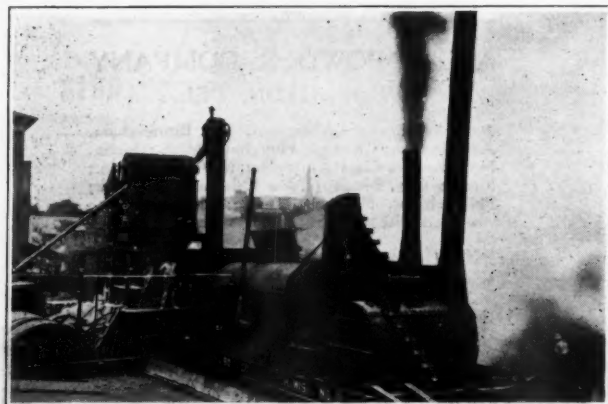
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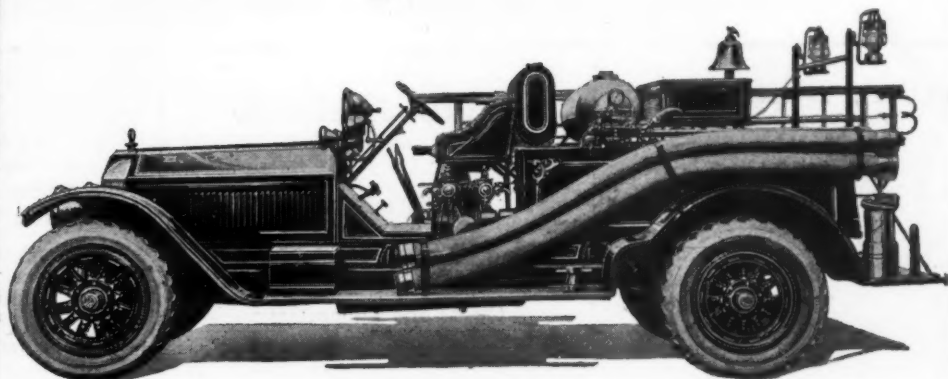


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New York City, where crowded buildings make fire extraordinarily dangerous, must have the best type of fire protection.

Fire apparatus in New York City must not only be built to operate efficiently at all times, but must be constructed so that it can be easily handled and driven through crowded streets.

For some time this largest of cities has seen the advantages of American-LaFrance motor apparatus. *This last re-order brings the total of American-LaFrance apparatus in New York City to*

**172 Pieces**

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1918 . . . . .	{ 10 Pumping Cars
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1920 . . . . .	21 Pumping Cars
1921 . . . . .	20 Pumping Cars
1922 . . . . .	{ 8 Pumping Cars
	{ 20 Pumping Cars
	109

The constant repeat orders from cities, where American-LaFrance Motor driven Fire Apparatus is used, give conclusive proof of its soundness of construction, efficiency of operation and general satisfaction.

*During the same month Philadelphia ordered 42 additional pieces, the largest single contract ever written and Boston ordered 10 additional pieces.*

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Ruberoid Pipe-seal compound has been endorsed and is used by prominent engineers throughout the country.

Many years of service in hundreds of sewer systems in the United States have proved its quality to be of the highest. It is easily used, liquifies readily, congeals rapidly, forms a permanent, flexible joint which is proof against infiltration and the penetration of roots. It will not crack while you are aligning the pipe nor through subsequent settling.

Write today for complete information regarding Ruberoid Pipe-seal. Descriptive matter and names of prominent installations where this compound is in service will be sent upon request.

**The RUBEROID Co.**

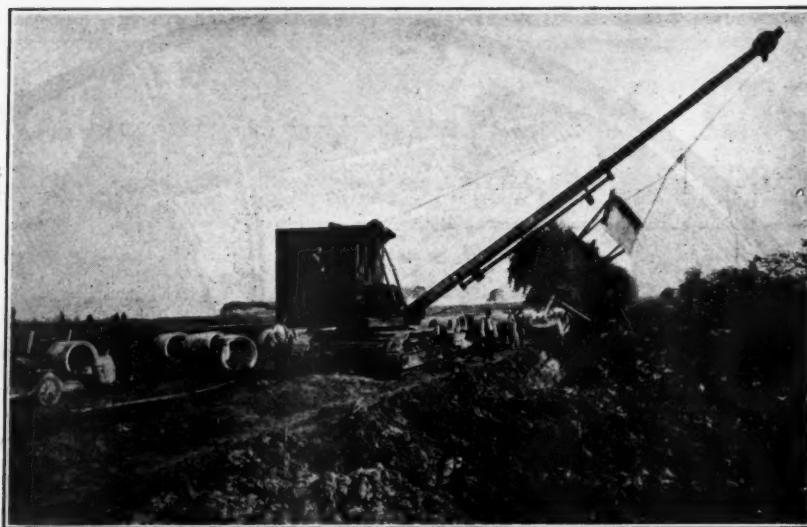
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# **RU-BER-OLD**

## **Pipe-seal**

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Concrete Pipe supplied to the City of Kenosha, Wisconsin. Note pipe placed along line of trench and ease in excavating and backfilling.

# STRENGTH-DURABILITY — SPEED —

## ***INDEPENDENT REINFORCED CONCRETE PIPE***

has proved its worth and durability through long years of reliable service.

Leading engineers are specifying Reinforced concrete pipe because it will give their community a lasting sewer. It is adaptable to all their projects, is true to shape; provides smoothest flow line, gives maximum service and carrying capacity. It has all the qualities of competitive materials and a great many additional advantages.

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*Easier to Lay—Cheaper to Lay—Faster to Lay*

**INDEPENDENT CONCRETE PIPE CO.**

INDIANAPOLIS, INDIANA



72" pipe built for the City of Muncie, Indiana. Note how pipe is placed along line of trench ready for contractor to lay.

*The most striking characteristics of Direct Oxidation plants are their attractive appearance their compactness, and the complete absence of odor and of flies.*



*Municipal Direct Oxidation Plant at Allentown, Pa.*

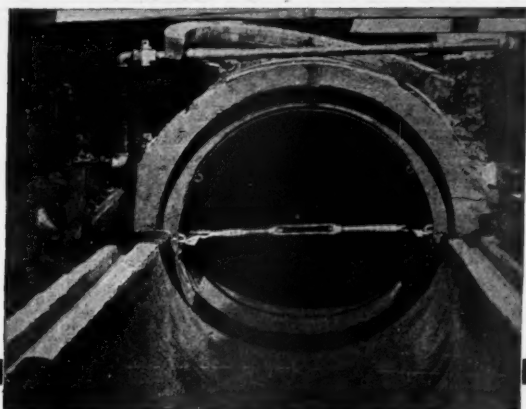
*Population 85,000*

*Direct Oxidation plants may be located adjacent to dwellings if necessary, thus in many instances saving the cost of trunk sewers.*

**DIRECT OXIDATION DISPOSAL  
CORPORATION**

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Consider the cost of lumber; the expensive expert labor required to build and knock down the forms and the large pile of almost useless lumber on your hands when the job is finished—and compare the appearances of a wood form and a steel form-built sewer.

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Blaw Sewer Forms of standard sizes and shapes are carried in stock—and leased to you. Sewers of especially large size or odd design require special forms, which we will design and build to suit your needs.

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Manhole, Catch Basin and Sewerage Castings of All Kinds. We Make Anything in Gray Iron  
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## G-K The G-K Sanitary Sewer

### Diagnosis

Circulation: Poor, owing to Root Growth.

Temperature (financial): Very high, due to unnecessary costs of treating ground-water infiltration.

**Rx.**

G-K Sewer Joint Compound—a. s. q.

**Sig:**

Use as directed.

*The Sewer Doctor*

## G-K Sales Agency

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Reinforced to withstand heavy traffic.

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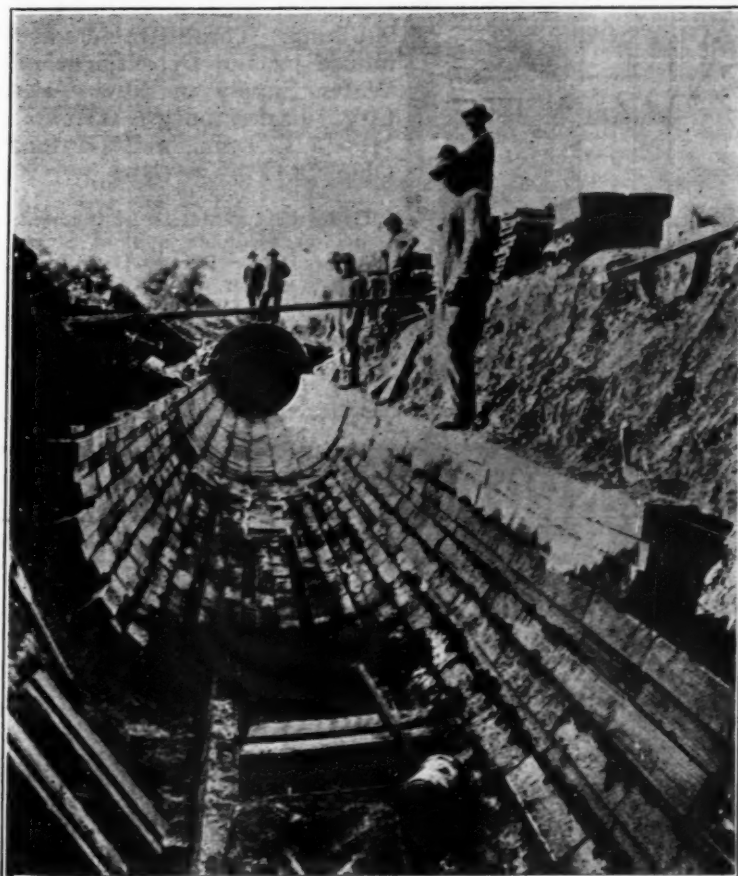


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THE WATER TIGHT  
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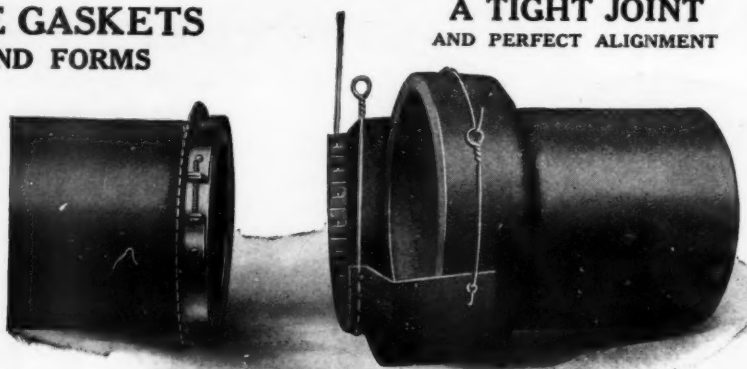
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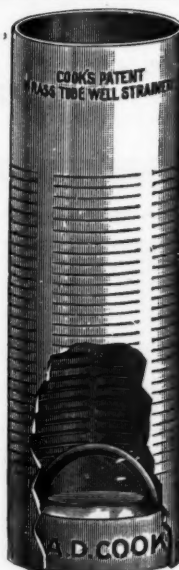
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We pay freight and ship for trial. Who else will do it?

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**R O D S**

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**If You Have a DEEP WELL  
ending in WATER-BEARING  
SAND OR GRAVEL.**

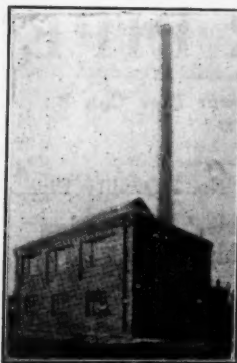
equip it with the COOK PATENT BRASS TUBE WELL STRAINER and secure the maximum capacity of the well free from sand or particles of any kind. These strainers are in use by the Department of Water Supply of New York City, Parkersburg, W. Va., Memphis, Tenn., and Dayton, Ohio.

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100 Ton Plant

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## FIRE DEPARTMENT EQUIPMENT

**Combination Chemical and Hose Wagons**  
American-La France Fire Engine Co.

**Fire Alarm System**  
Loper Fire Alarm Co.

**Fire and Chemical Hose**  
Goodyear Tire & Rubber Co.

**Pails**  
Rochester Can Co.

**Pumping Engines**  
Gasoline  
American-La France Fire Eng. Co.  
De Laval Steam Turbine Co.

**Tires**  
Goodyear Tire & Rubber Co.

**Triple Combination Motor**  
American-La France Fire Engine Co.

**Underwriters' Pumps**  
De Laval Steam Turbine Co.

## MISCELLANEOUS

**Drawing Materials**  
F. Weber Co.

**Engineering Supplies**  
F. Weber Co.

**Tanks, Welded Steel**  
Heil Co.

**Transits and Levels**  
F. Weber Co.

## PAVING AND ROAD MACHINERY

**Air Compressors, Portable**  
Ingersoll-Rand Co.

**Asphalt Distributors**

**Asphalt Plants**  
Cummer & Son Co.  
Farasey, J. D., Mfg. Co.  
Hetherington & Berner  
Warren Bros. Co.

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Acme Road Mchy. Co.  
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Good Rds. Mchy. Co., Inc.

**Concrete Mixers**  
Good Rds. Mchy. Co., Inc.  
Jaeger Mch. Co., The  
Koehring Co.  
Republic Iron Works

**Culverts, Corrugated Metal**  
Newport Culvert Co.

**Gravel Screening Plants and Loaders**  
L. P. Green  
Russell Grader Mfg. Co.

**Heaters**  
Honhorst, Jos., Co.

**Oil Distributors and Sprayers**  
Acme Road Mach. Co.  
Austin-West. Rd. Mach. Co.  
Connelly & Co., Inc.  
Good Rds. Mchy. Co., Inc.  
The Kinney Mfg. Co.

**Paving Breakers**  
Ingersoll-Rand Co.

**Pumps—Oil and Asphalt**  
The Kinney Mfg. Co.

**Road Graders**  
Acme Road Mchy. Co.  
Austin-West. Rd. Mach. Co.  
Ball Engine Co.  
Erie Steam Shovel Co.  
Good Rds. Mchy. Co., Inc.  
Russell Grader Mfg. Co.

**Road Drags**  
Acme Road Mchy. Co.  
Austin-West. Rd. Mach. Co.  
Good Rds. Mchy. Co., Inc.  
Russell Grader Mfg. Co.

**Road Levellers**  
Holt Mfg. Co., Inc.

**Road Maintainers**  
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Austin-West. Rd. Mach. Co.  
Russell Grader Mfg. Co.

**Road Pavement Testing Machines**  
Ingersoll-Rand Co.

**Road Rollers**  
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Avery Co.  
Austin-West. Rd. Mach. Co.  
Buffalo-Springfield Rol. Co.  
Good Rds. Mchy. Co., Inc.

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Austin-West. Rd. Mach. Co.  
Good Rds. Mchy. Co., Inc.

**Rock Drills**  
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Motor Tandem Rollers  
Austin-West. Rd. Mach. Co.

**Scarifiers**  
Acme Road Mchy. Co.  
Austin-West. Rd. Mach. Co.  
Avery Co.  
Buffalo-Springfield Rol. Co.  
Good Rds. Mchy. Co., Inc.  
The Hug Co.  
Russell Grader Mfg. Co.

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Austin-West. Rd. Mach. Co.  
L. P. Green  
Good Rds. Mchy. Co., Inc.  
Root Spring Scraper Co.  
Russell Grader Mfg. Co.

## Screens

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L. P. Green  
Russell Grader Mfg. Co.

## Shovels

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## Spreaders

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Connelly & Co., Inc.  
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Warren Bros. Co.

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Holt Mfg. Co., Inc.

**Turn Tables**  
The Hug Co.

## Wagon Loaders

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Standard Oil Co. (N. Y.)  
Texas Co.

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Standard Oil Co. (Ind.)  
Standard Oil Co. (N. Y.)  
Texas Co.

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Texas Co.  
Warren Bros. Co.

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**Cresoted Wood Block**  
Republic Creso. Co.

**Culverts, Corrugated Metal**  
Newport Culvert Co.

**Curb Bars**  
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**Expansion Joints**  
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Philip Carey Co.  
Servicised Products Co.  
Truscon Steel Co.

**Fluxing Asphalts**  
Standard Oil Co. (Ind.)

**Oil (Roads)**  
Barrett Co., The  
Headley Good Roads Co.  
Standard Oil Co. (Ind.)  
Standard Oil Co. (N. Y.)  
Texas Co.

**Paving Fillers**  
Standard Oil Co. (Ind.)

**Reinforcing Mesh**  
Truscon Steel Co.

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The Robinson Clay Prod.  
Russell Grader Mfg. Co.

**Culverts, Corrugated Metal**  
Newport Culvert Co.

### Drain Tile

Robinson Clay Prod. Co.

**Flush Tank Siphons**  
Pacific Flush-Tank Co.

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**Joint Compound (Bituminous)**  
Ruberoide Co.

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Flockhart Foundry Co.

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U. S. Cast Iron Pipe & Fdy. Co.  
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Pacific Flush-Tank Co.

**Sewage Disposal Plants**  
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**Sewage Ejectors**  
Pacific Flush-Tank Co.

**Sewage Pumps**  
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East Ohio Sewer Pipe Co.  
Robinson Clay Prod. Co.

**Vitrified Sewer Pipe**  
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East Ohio Sewer Pipe Co.  
Ohio Vitrified Pipe Co.  
Robinson Clay Prod. Co.

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Columbia Wagon & Body Co.  
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Stacy-Bates Co.  
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Hersey Mfg. Co.  
Pittsburgh Meter Co.  
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**Pipe, Wood**  
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# PENNSYLVANIA



**Texaco Asphaltic Concrete on Lackawanna Trail, Pennsylvania State Highway System. Laid in 1919.**

Coal!  
Iron!  
Steel!

These are the names of great staple commodities which we associate with the State of Pennsylvania.

The names of these products alone convey an atmosphere of solidity and strength. They make us visualize enormous furnaces, great mills, mammoth mines. And if we go a step further, we visualize enormous transportation systems made necessary to ship the huge quantities of coal, iron products and steel which Pennsylvania sends forth each year.

# A N D



**Texaco Sheet Asphalt on Route 82. Work done by Smith Construction Company. (Blast furnace slag used in concrete foundation.)**

Pennsylvania has had to provide durable highways not alone leading from great cities like Philadelphia, Pittsburgh, and others, but has had to provide outlets by roadway from the great mining and industrial centers.

TEXACO Asphalt highways have formed an important link in the chain necessary to complete Pennsylvania's road system. TEXACO Asphalt pavements on the great Lackawanna Trail and other main routes speak for themselves in excellence and durability.

# TEXACO



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Memphis

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Kansas City

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